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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART,
ORIGINAL ARTICLES

Problem of Irrigation in the South of Italy and in Sicily

by

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The distribution of rainfall in the South of Italy and Sicily is characterized by a very low precipitation during the summer, as is the case in the Mediterranean region, to which those countries belong. During the summer the Adriatic slope of Apulia, Lower Basilicata, the west of Calabria and almost the whole of Sicily register a rainfall not exceeding 50 mm. (2 inches), while for the rest of the country it is between 50 and 100 mm. (2 to 4 inches). Throughout the whole region the small amount of rain that falls between April and the end of September takes the form of rare and light showers. On the other hand, the autumn and winter months are rainy, even cloudbursts occurring sometimes.

Owing to the summer drought, farmers must by preference keep to the dry sown crops, such as wheat and other cereals, beans, and a few fruit plants, when they cannot plant vines, almonds, olives and other fruit trees which are less exacting than herbaceous plants as to moisture in the soil. Sowing spring hoed plants would mean almost certain failure, and thus the soil in those regions is deprived of the advantage which hoed plants give it into a rotation; the production of forage and consequently of stable manure are considerably limited, whence even now, notwithstanding the frequent use of leguminous leys with chemicals, bare fallows frequently become an absolute necessity in the cultivation of cereals. The dryness of the soil and of the soil sometimes cause the above fertilizers to give scanty and even negative results.

From the above it will be clearly understood of what immense advantage is the possession of even a small amount of irrigation water. The possession of 8 inches, or 21 000 to 28 000 cubic feet per acre, of water signifies the difference between the success of wheat and bean crops in the frequent years in which the drought

begins in spring and continues throughout the summer. It represents further, the possibility of growing hoed crops instead of resorting to fallow, of getting a great deal more out of the poor permanent pastures, of doubling the produce from grass leys. Even the vine, the olive and other fruit trees, which in some years suffer from the persistent summer drought may be greatly benefited by a moderate irrigation, and their crop ensured.

Irrigation in southern countries, assisted as it is by the higher temperature, is much more efficient than under northern climates, and its effects are sometimes quite extraordinary. There are, for instance, irrigated market gardens in Campania which are rented at £12 10s to £16 an acre, besides which all the expenses for irrigation are charged to the farmer. In Calabria and in Sicily a delivery of 13.2 gallons per minute, which is equivalent to 530 000 to 565 000 cub. ft. in six months, is sufficient for crops of 5 to 7 $\frac{1}{2}$ acres, which yield up to £240 income from the land, whence geologist Comm. Baldacci was justified in saying that the above amount of water represented a profit of £120 a year.

This explains also the high prices paid for water in the South of Italy, namely $\frac{1}{2}$ d, 1d, up to 1 $\frac{1}{2}$ d per cubic metre, (35 cub. ft.), while in the North of Italy the managers of the Cavour Canals sell their water during the summer at less than a twentieth of a penny per cubic metre. It is evident that in the South it is of capital importance to treasure up every drop of water flowing on the surface or hidden in the depths of the soil. In this direction a good deal has been done, but a great deal more remains to be accomplished, especially for the systematic and continuous utilization of the greater water supplies of the country, in spite of the great technical and economic difficulties due to the nature of the water courses and to surface features.

The water courses, owing to the distribution of the rain as mentioned above, are generally of the nature of torrents: that is abundantly supplied with water during the autumn and winter, to the extent of being sometimes injurious, while in summer the amount of water conveyed sinks frequently to nothing. At the latter season only the Pescara, Sangro, Biferno and a few other rivers of the Adriatic slope of the Abruzzi convey a certain amount of water. Apulia to the south of the Ofanto river, which is almost dry in summer, has no visible water course, not even in winter: the rainfall disappears immediately in the subsoil through the mass of limestone fissured in all directions which is the prevailing formation of that region. On the Mediterranean slope there are important streams in Campania, such as the Garigliano, the Volturno, the Sarno and the Sele, some of which afford fairly good summer irrigation, but beyond the limits of the above named rivers the features and hydrography of the country are very unfavourable to extensive irrigation works.

Indeed from the Sele to the extreme south of Italy all the country is mountainous and therefore unsuitable to the economic collection and distribution of irrigation water. Along the sea shore from Paestum to Reggio and from Reggio to Metaponto on the Ionian Sea the slopes are very short, sometimes only six or nine miles in length, so that they are

to an infinite number of very small catchment basins; the rainwater falls on these is conveyed to the sea in a few days and sometimes even in a few hours. The wanton deforestation begun some centuries ago, but continued vigorously in the last century, renders this outflow of water more rapid and increases the difficulties of the problem. Sicily is in very similar conditions for the mountainous character of the country, the shortness of the slopes, and still more for the frightful bareness of the mountain sides. Neither in Sicily nor in the South of the peninsula, are there any high mountains which keep covered with snow throughout the year or even in the summer, as is the case in the Alps, whose snow and ice feed the rivers of the Po valley. The greater part of the mountains of the south rise higher than 3300 to 5000 feet, and by the month of May they shed all their snow.

This renders the problem of irrigation difficult to solve, even in the plains of the coast which would be much benefited by watering. Nevertheless, it would be unjust not to recognise that wherever possible farmers for some time done their best to utilize the greatest quantity of irrigation water. There are a great many irrigation works; the least of them are open canals of a certain importance, the greatest consisting of systems of raising or otherwise utilizing water from the soil.

Some canals exist in Campania between Vesuvius and Nocera and between Salerno and Eboli. The remains of ancient works bear witness to the cities of Magna Grecia and the Romans had excavated important works; thus those of Sybaris were considered works of considerable utility and of great beauty. It is certain that the rivers rising in the mountains of the South, which in those days were covered with forests, were richer in water than they are at present, whence it was easier to feed canals (1). While canals are rather rare, there are great numbers of irrigations on a small scale in which the water is raised from the subsoil or from water-courses. There is no region without some of these, and Campania is especially well supplied with them in the rich belt between Capua and the Sele. There are numerous also in the provinces of Bari and Lecce, especially near the coast; here the water is utilized notwithstanding its relatively brackishness. Water-raising installations of considerable magnitude exist with in Calabria in the neighbourhood of Reggio, and in the ter-

(1) At Venafro in the upper Volturno valley a tablet was discovered, the so-called "Agrarian Table" which was the regulation for the use, by an association, of the irrigation water derived from that river. Lenormant, in his works *La Grande Grèce* and *À travers l'Italie à la Lucanie*, cites texts and inscriptions, and mentions remains which prove the existence of canals and irrigation at the time of the Greek colonies in Southern Italy. Angelo Mosso, in his work *Vita Moderna degli Italiani*, describes the ancient water works of Syracuse, where at present there is hardly water enough for drinking purposes, and comes to the conclusion that Syracuse, owing to the neighbouring mountains being covered by forests, had then more water than the best supplied large cities of the present day.

ritories of Messina and Palermo. They possess steam pumping plants and raise water from wells 65 to 85 feet and more deep. Sicily has besides an admirable system of irrigation with water from the Simetis in the plain of Catania and in the plain of Terranova on the south coast.

The machinery with which water is raised consists mostly of norias, water wheels with chains of buckets of primitive construction, or with wooden gearing and esparto ropes, with which often barely one third of the animal power employed is utilized. Where the water is not far below the surface of the ground see-saw buckets are used, or winches with leather or wooden buckets which remind one of the systems used by the Arabs along the Nile. Recently, especially in the neighbourhood of Naples, pumps with electric motors have been introduced; they permit the economical utilization of water from wells which would be too deep for the usual norias.

With the above means, raising water is always a very costly process. The best norias over wells 16, 33 or 40 feet deep supply water at about 1 $\frac{1}{2}$ d or 2 $\frac{1}{2}$ d or 3 d per 100 cubic feet. At the same prices water is sold in the neighbourhood of Palermo by large steam pumping installations; in the territory of Messina, where the ingenious system of underground dams and filtering galleries prevails, the price reaches 4 $\frac{1}{2}$ d per 100 cub. ft.

In that district, as in Calabria, the mountain slopes are very steep and the torrents which descend along them have excavated very deep beds in the prevailing crystalline rocks. These beds have since been partly filled up with coarse and incoherent material carried down by the water, which even when it is perennial percolates through the loose material and flows hidden from sight on the bed-rock under the rubble. Long ago the farmers learned to dam these underground streams by means of barriers resting on the bed-rock, which cause the water to rise against them and flow into galleries excavated just above the base of the dam and provided with apertures to receive the water. These galleries lead first to underground conduits and then to open channels which convey the water to irrigate the soil; thus even steep slopes, which have been turned at great expense into terraces sustained by the usual masonry or dry stone walls, can receive irrigation.

Such works are to be found in Calabria about Reggio, in the district of Palermo and in other parts of Sicily. Many of them are of recent construction in spite of their heavy cost, which does not allow them to supply water at less than 3 d or 4 $\frac{1}{2}$ d per 100 cub. ft. Several of these works supply drinking water to inhabited centres.

From the foregoing it is seen that in the provinces of Southern Italy and of the islands there is a great prevalence of small and very small irrigation works, the greater proportion of which raise water from the soil at a price that only the high productivity of the irrigated crops allow to be paid without working at a loss.

The State has always endeavoured to further irrigation throughout the whole country, but it has bestowed most care on the valley of the Po which possesses in the installations of Piedmont and of Lombardy examples of irrigation works unique in the world. Several causes favoured

of irrigation in those provinces, especially the facility with which associations of landowners were formed for the construction of the minor canals intended to receive the water from the main canals excavated by previous Governments and by the present one. Considering the success which these associations had conferred upon that part of the law for centuries, it was thought advisable to favour the constitution of similar associations in the South of Italy, but the attempt failed completely on account of the lack of tradition of such organizations and of the want of free initiative.

Laws on the matter were enacted in 1873 and 1886, while the law of 1890 promoted associations for reclaiming lands. Irrigation associations were granted yearly subsidies amounting respectively to 3, 2 and 1 per cent. of the capital spent during the 1st, 2nd and 3rd decade from the execution of the work. These grants were, however, subordinate to the condition that at least 106 cub. ft. of water per second should be conveyed. With quantities of water not inferior to 10.6 cub. ft. and in exceptional cases to 5.3 cub. ft., this subsidy was reduced to two-thirds of the above. Thus the law of 1890 excluded from the benefits of the law, and notwithstanding the fact that fiscal concessions offered to new associations, it was not possible to substitute a single one, though here and there good private initiative was not wanting.

The State realized then that a different plan should be followed, and in the first place it was necessary, in order to provide the greater part of the South of Italy and the islands with water, to study the possibility of utilizing the surplus winter water of the rivers by means of dams. Hence preliminary surveys were made with the intention of enacting new laws in the matter. Financial difficulties, however, prevented the realisation of these projects, and it was only by the law of August 2, 1897, for Sardinia that funds were voted for the creation of artificial reservoirs; some of these are in course of construction. (1).

At the same time the Ministry of Agriculture began collecting materials for the study of the hydrography of Italy. A special office was opened for this purpose, at first under the management of Sig. Zoppi, C. E., and now of Sig. E. Perrone. It published the hydrographical map of the kingdom, in which the most important features are shown (catchment basins, volumes of rivers, dams, water works, canals, irrigated and irrigable lands, etc.). An important series of memoirs accompanies this map and contains the results of investigations of the office on the measurement of the volumes of rivers, and on the hydrographical and irrigation condition of the various provinces. These memoirs have been, and still are, very useful to those who intend to divert water for agricultural or industrial purposes.

(1) Whilst this is in the press the Government has presented to Parliament a bill for the construction of artificial reservoirs in Sardinia and Calabria, with the object of supplying water for irrigation and for motive power.

For the solution of the irrigation problem, what was still wanting, a complete review of all the water resources of the country and of the means and convenience of utilizing them. In 1910 therefore, on the proposal of the Parliamentary Commission of Enquiry into the conditions of the peasantry in the South of Italy and Sicily, a special law was passed for the appointment of a Royal Commission — to which the writer belongs — to study the subject. It was agreed that the Commission should begin its work in April, where disastrous droughts are frequent. One of the most memorable ones was that of 1908, during which drinking water had to be conveyed by railway.

The above-mentioned Commission, under the presidency of C. Guisso, began immediately to enquire into the hydrographical conditions of the three provinces of Apulia (Foggia, Bari and Lecce), taking stock of their water resources, both latent and visible, and commencing to examine the question of reservoirs for that region. A few months after its appointment on June 30, 1911, the Commission presented its first report to Parliament; in this, after a general review of the problem of irrigation in the South of Italy, it communicated the results of the first enquiries made in Apulia by a special committee and its opinion on the feasibility of constructing reservoirs. The committee had visited the valleys of the Ofanto, of its tributaries, of the Fortore and the principal coast sources of the province of Lecce (« heel of Italy »), and had come to the conclusion that extensive irrigation was possible. The report discussed also the possibility of making use of the surplus water of the Apulian aqueduct, which, starting from the sources of the Sele on the Mediterranean slope, conveys through 112 miles of main covered aqueduct the water that the inhabitants of Apulia require. When the regular distribution of this water is made, waste and sewage water from the inhabited centres will also be available for irrigating and fertilizing. This very complex problem has also been studied by a special commission appointed by the Ministry of Public Works. (2).

The Royal Commission proposed to the Minister to present a new law authorising the State to grant up to six-tenths of the cost of the works required by the small irrigation schemes of Southern and Central Italy, which were debarred from availing themselves of the law of 1886. The Minister of Agriculture, Prof. Nitti, has recently renewed the assurance that he would present a bill on the subject, the conditions of the country having permitted it to be done before now.

The commission will shortly present a second report, now being prepared, containing detailed reports on the following subjects :

(2) Unfortunately, little or nothing has been done in this direction in the South of Italy. The city of Naples itself, which has constructed a splendid system of sewerage at the cost of upwards of £800,000, allows 11.8 cub. ft. per second of sewage water to run to waste into the sea, below Cuma, instead of using the benefit of the adjoining country.

1). Construction of a large reservoir on the Fortore river in the province of Foggia for the storage of about 7 000 000 000 cub. ft. of water for irrigation of 100 to 125 thousand acres of the plain of Apulia between it Gargano and the Apennines. The extent of land benefited by the irrigation might even attain 173 000 acres with the help of a derivation from the basin of the Biferno by means of a tunnel through the hills which divide the two valleys.

2). Examination of other proposed reservoirs on the Locone and Lirina, tributaries of the Ofanto, and on some rivers of the Basilicata.

3). Study of the problem of raising water from the coast sources of the Lucania district for the irrigation of the higher-lying plateaus.

4). Report on experiments on the use of brackish water (containing about 7 per 1000) in irrigation, conducted by Prof. Celso Cipiani of the Royal School of Agriculture at Portici and by the writer. The experiments are being continued.

5). Report on the work done in Liguria by a special commission, on minor matters and on the programme for the next years.

In the latter is included an examination of the conditions of the district most in need of water for irrigation, among which Sicily receives particular attention; in it detailed investigations will be made.

Thus the problem of irrigation in the South of Italy seems to be about solved in the best way that the conditions of soil and of climate allow. Firstly, irrigation in the southern districts may find much assistance by the use of the so-called "serbatoi a corona". These are artificial reservoirs for rainwater or for the water of temporary streams, made by digging a semicircular space at the base of the hills or in the hollows between them by embankments not exceeding 33 to 40 ft. in height. Thus 3 500 000 to 7 000 000 cub. ft. of water, and exceptionally 17 500 000 cub. ft., can be stored; at the rate of 56 000 to 70 000 cub. ft. per acre allows fairly large extents of land to be irrigated. The provinces of Calabria and Piacenza possess a good number of such reservoirs at the foot of hills along the Apennines, where the prevailing clay formations supply excellent material for the embankments. The Hon. Raineri, as President of the "Federazione Italiana dei Consorzi Agrari" (Italian Federation of Agricultural Cooperative Associations), has published a work on such reservoirs constructed in that region up to 1904, which may be consulted with advantage by those who wish to have a clear idea of an easy and economic method of storing water for irrigation.

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The Swedish Institute for the Improvement of Field Crops at Svalöf

by

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The foundation of the Svalöf Station was due entirely to private initiative, in fact to the farmers themselves. Its aim was to supply Swedish agriculture with improved and new seed. The realization and development of the original project have up to the present remained under agricultural

tion, though the bulk of the necessary funds is now supplied by the State.

The natural consequence has been that the first and sole object of the undertaking is to achieve practical results. For this reason, it has been in special cases that scientific experiments have been carried out, then only on subjects directly connected with questions of practice. At the same time, it was happily seen from the beginning that only expert agronomists could direct the variation and genesis of new forms into the desired channels, that is to say lead them up to the creation of real rural varieties adapted to their country and of high yielding capacity. It was also understood that the work must be strictly specialised, and concentrated on this one point: such subjects as teaching, comparative trials, and commercial analyses, which are often such a severe strain on the programme and staff of Experiment Stations elsewhere, foreign to this particular line, and must be set aside.

It is to this free organization, to the carefully adapted programme, to the intimate contact with farming practice and farmers, combined with the use of the best methods and resources of Science, that one must look for the explanation of the fact that a humble provincial institution of such comparatively poor country as Sweden, with a rather unfavourable climate, has been able to contribute to the reorganization and development of the improvement of cultivated plants to such a remarkable extent as the results of the last quarter of a century show. Another cause of success is undoubtedly its purely agricultural organization.

The question of seed supply had already been long prominent among Swedish farmers when M. B. Welinder, a young landowner at Svalöf, assisted by Baron Gyllenkrook and various other farmers in the province, founded in 1886 a local society for seed improvement. In a short time it attracted so much interest throughout the country that it rapidly extended from the Society for the Improvement of Agricultural Plants in Sweden (*Svenska Utsädesföreningen*). One after another, all the Swedish Agricultural Associations, even the most northerly ones, sent in subscriptions, and at last the State also made a grant. At the same time some thousand members from all over the country gave their financial and moral support.

The undertaking was annexed to a free association of farmers, so as to secure their direct interest in the work going on, as well as their regular subscriptions. There are two classes of members: life members, who pay about 100 shillings once for all; and annual members, who pay 5s 6d a year. A committee of seven members — farmers and others — acts as executive, finance committee, etc.; three of these are elected by the Society itself, three by delegates of the Agricultural Associations who form a consulting council, and one by the State. The Society publishes a periodical Review, as well as special leaflets as required. By giving advice, making expert judgments, conducting local comparative trials and special seed shows, examining local varieties, and other such work, the Society endeavours to carry out as far as possible the task which it has set itself, namely of bringing about a general improvement in the growing of crops in the country.

The funds required for carrying on the work come from various sources. The members' annual subscriptions give an average of about £147; the cultural Associations have given about £385 a year, latterly rather more; the State gave £833 a year from 1890 to 1905, and since then has given £2 222. At present, there is a proposal under consideration for reducing the State grant to £4 444; this would include the subscriptions from the Agricultural Associations, who would withdraw their support. The introduction of new varieties (which will be referred to later) has brought in to the Society a steadily increasing profit; in the period 1901-06 it averaged nearly £1 000 a year, and has now reached £2 440. Thus the income of the Society for 1913 is about £6 000. Out of the subscriptions of the life members (totalling some £2 000), a fund was set apart for buildings; these were liberally endowed by friends of agriculture, showing what great interest has been aroused by the undertaking: the total endowment is now £15 000.

The Society has now a large and well-equipped establishment, comprising two buildings for laboratories, a building for seed preparation, a farm and a dwelling-house. The land is 40 acres, of which 25 are reserved for special plots and for increasing the seed-supply. All the same, it has been found necessary to grow the greater number of the trial crops on real experimental plots — on the large estate adjoining, so as to give various cereals (together occupying 30 acres) their proper place in rotation; this has been found absolutely essential for normal development.

History of the development of the methods of work. — The starting-point of the work was naturally methodical selection, which was accepted and adopted everywhere at that time, in accordance with Darwin's theory, considered capable of resolving the problem of the formation of species and of nature. A treatise on these ideas, characteristic of the epoch, was published by K. Rümker in Berlin in 1889, under the title of "*Getreideschöpfung*"; this was considered from 1890 to 1910 as a classical summary of the elements on the improvement of agricultural plants. It must suffice to say that it was believed that the continued and methodical selection of plants showing some common quality or tendency, would lead to the creation of a new and constant form containing this desired quality as a distinct and hereditary character.

It was not till ten years later that a serious criticism of these ideas was made by Hugo de Vries in his work "*Die Mutations-theorie*" (1st ed., Leipzig, 1901); he threw considerable doubt on the view that the advance already made in plant improvement had been really obtained by this method, and illustrated its insufficiency from theoretical considerations as well as by reference to his own experiments. It so happened that the new method of work which he wished to substitute for the old had already been carried out at Svalöf for ten years; this was shown by the hundreds of true varieties produced there by the new method. Let us now go into the details of this development at Svalöf.

It was not without careful criticism that Von Neergaard, the scientific director of Svalöf, based his work on methodical selection. In particular, he endeavoured to simplify and bring under more natural

mal conditions the growing of the trial crops, which had previously given forcing treatment; also to replace approximate estimation of the qualities of the plants by numerical determinations of weight, bulk, and size. For this purpose he invented several new instruments and introduced new methods of research. In this way it became possible to control the ultimate variations and their relative stability. Methodical selection was thus made the subject of scientific criticism for the first time. In 1890, when I took over the direction of the work, I had to get out as far as possible a general summary of the observations for the subscribers. In spite of the extent and intensity of the later selection work, this did not show the results which we had considered we could expect. Years of rigorous and continuous selection had given only a relative uniformity, and no distinctive or stable new variety character could be reached. But the most obvious thing was that "élite" varieties, when left to themselves for a year or two, fell back into the mixed condition of the original varieties. The demand of Swedish farmers for better, and more stable varieties could evidently not be met in this way. The only way was to look for another method, based on firmer scientific foundations. This was the rather hopeless state of affairs at the beginning of 1891.

By the summer of 1893, however, the difficulties had already been overcome; by then a new method was in practice at Svalöf, promising the certain accomplishment of the aims which the Society had set itself. In my second year at Svalöf (1889), my botanical instinct had led me to pay careful attention to all sorts of curious forms which occurred among the old cultivated varieties. Would it not be possible, I thought to myself, to produce by growing these, new varieties as good as those at which the slow and systematic improvement of the original varieties was aiming?

The work was begun forthwith. Preparatory experiments in 1890 with 30 different types of spring wheat and vetches, continued the following year with 291 types, gave unsatisfactory results; so in 1892 I brought the number up to 1 000, comprising all the crops then under investigation: wheat, barley, oats, peas and vetches. At first the result seemed rather encouraging, but all the same I observed here and there certain winter crops which at once opened to me fresh perspectives. Although only about 5 per cent. of the total number, they showed characteristic and unique types, different from anything we had seen in our crops; it was evident that their value was utterly different from that of the rest. On referring to the registers of the origin, treatment, etc., of the seed with which the plots had been sown, we saw that each of these plots had come from a single ear, or (what comes to the same thing) from a single plant. This directed our attention to the importance of the individual in improvement work. This was for us quite a new idea, and from the scientific point of view inspired us with eager hopes.

To get a definite solution of the question, we made a general field experiment in 1893, of separate plots derived from characteristic individuals (100 different numbers). The result was most convincing: it left no doubt

that the only true point of departure for fixing the types found in the previous work would be the individual plant, and also that the only unit to be reckoned with would be the complete living plant, not (as had been considered previously) its parts, such as ear, spikelet, grain, to which different hereditary tendencies had been attributed.

The Svalöf improvement method. — On this new basis, the problem of improvement bears a completely fresh aspect, and one gets glimpses (which did not realize it at all at the time) of a long perspective of work along this line. We had confirmation of this as soon as the work had been carried on the new principle for a short time.

Firstly we succeeded in showing that most of our material consisted of a host of independent forms, with highly divergent qualities and varied value in farming practice. By separate culture starting from a single plant (pedigree culture), which is very easy to control, we also found that the majority of these forms were stable, only rare cases of segregation like the results of crosses, occurring. Thus, instead of being unable to produce a single truly stable form, we can now create any number of such and constant varieties suitable for growing.

Following the old selection in mass and the methodical line of work was really equivalent to depending on chance, so that no-one knew or when uniformity, of such paramount importance, would be reached even if it would ever be reached at all. But starting, as we do now, with pedigree cultures, all fear of being held up by insurmountable variability is avoided. The varieties are already in existence and fixed at the beginning of the work; the difficulty remaining is to learn to know them and to estimate their value properly. Thus the chief and only decisive work does not come till after the fixation of the already existing variety.

The long series of selection operations which previously had to be carried out year after year on thousands of plants and their various parts (the culms, different culms and ears, spikelets and individual grains) has become superfluous now that the whole plant is the unit dealt with in comparison with all the other individuals of the same generation. The various instruments, which were till then necessary in the research, have been set aside as museum objects, to be used at most for control examinations (1). Instead, the experiment field has become the centre of the estimation work.

Pedigree culture has, however, been of only secondary importance in the work at Svalöf; it has been used as a preparatory and practical auxiliary for the classification of the material to be used. The chief interest, as well as the fundamental work, is concerned with the subsequent examination of these innumerable fixed minor species, to find what characters they contain which are of importance in practice.

The decisive characters in each species occur in enormous numbers and in the allied forms present an extraordinarily abundant series of

(1) The followers of the Svalöf method in other countries do not seem yet to have reached these consequences of individual improvement, a fact which should be noted.

ions; for this reason the comparative estimation becomes a very difficult matter, especially seeing the work must start from as large and varied series of forms as possible, so as to have the best chance of finding the best. Since the date mentioned, the greater part of the work at Svalöf has been devoted to these problems.

A beginning was made by dividing the work among the different competent members of the staff, each one taking over a section confined to one species. Then, by making a careful study of his own material, with some investigation and field trials, each member came to perfect himself in his special branch, and trained his eye firstly to distinguish the different forms and secondly to judge the relative value of the characters.

The fact that we have generally been able to draw up natural classifications, in which strictly morphological characters indicate the absence or presence of certain properties determining the practical value, has been an inestimable advantage. This allows us, even in the first search for parent plants, to advance a little in some desired direction.

For the final and only decisive estimation, namely that of the agricultural value, it has been necessary to have recourse to field trials. The fact that our Institute, owing to its intimate relation with farmers, has wholly natural organization and equipment, has been a great help. The practical value of the hereditary qualities of the numerous new forms has been determined at Svalöf exclusively by growing the descendants of élite plants under field conditions. To arrive at this practical value usually requires cultivation and severe criticism carried out over a long series of years.

Naturally many practical arrangements have been required in carrying out all these processes with the exactness and order indispensable in dealing with material comprising thousands of forms each year (in 1912 there were over 9 500 numbers on the trial plots). Special genealogical charts (suitable for the classification of fixed species) were drawn up, with others referring to parallel genealogical collections, as well as to the trial plots, the registers and the tables.

The order of work was fixed in its general lines in a few years; thus it was shown for the first time at the General Swedish Agricultural Show in 1906, by several hundred new and stable varieties, already compared one with another.

By the great variety of constant forms thus shown to exist in our material, the improvement of field crops was built on a much wider basis than with the old method, which could only deal with a few specially good varieties. The possibility of producing valuable novelties was thereby greatly increased, as the available characters were very diverse, comprising a wide range of ripening, resistance to winter and to diseases, etc., all qualities of great practical value, but previously beyond the reach of improvement.

These forms, regarded as agricultural varieties, are of a stability which considerably prolongs and widens their use, as they do not need frequent

renewal by the purchase of fresh seed. Their stability embraces a lot of characters and qualities whose transmission could not be reckoned before. As this stability affects all the plants, at any rate in the first generations, the hereditary peculiarities become more obvious in the variety in question than in others, a circumstance which greatly facilitates estimation and control.

We may now enquire into the nature of all these minor species which have allowed the division of the old material into new and independent forms. Do they come from mutations, or from spontaneous crosses from both together? That mutations appear from time to time in crops has been observed also at Svalöf. Further, it has been found that spontaneous cross-fertilization is much more frequent than was imagined. But it must not be supposed that the origin of the forms can be ascertained for certain in every case: indeed, this hardly matters for practical purposes, as for this it is enough to know that these forms exist. In any case, it should be noted that the final results of these two different types of crosses are of the same nature, in that they induce in each group of forms a multitude of systematic units, distinguished among themselves chiefly by varying combinations of a certain, and often very small, number of characters. They are all what have been termed "minor species", or "elementary species". M. Johannsen, who later made a thorough study of the matter, refers to them as "pure lines"; here we have, for practical reasons, to the English word "pedigree."

Although our first experiments on this subject dealt with autogamous species (wheat, barley, oats, peas, vetches), our later experience with clover, forage grasses, beets, etc., brought us to the conclusion that in autogamous plants there exist analogous independent minor species. In allogamous plants, however, they naturally do not show uniformity immediately after isolation. They require systematic treatment for several years before they acquire a satisfactory degree of purity and stability, and they never become as perfect as in autogamous species. But it has already been shown that these forms can be used to bring about the same practical results as the others. The extension now in progress at Svalöf is chiefly intended to give scope for more intensive treatment of these groups, by final selection, varieties and practical testing.

Crossing work at Svalöf. — Another means of producing new forms in field crops is artificial crossing. About 1895 we were so much occupied with testing the value of all the forms obtained by the examination of old varieties that we had no chance of taking up this question seriously. The extensive crossing experiments which we made a few years later did not give encouraging results. All the same, the winter wheat Svalöf Squarehead II, eventually so famous, came from this first series of crosses.

As we accumulated rich assortments of well tried new varieties, characteristic and stable, each with some special quality of practical value, it was natural that we should try to establish other and better combinations of these qualities by systematic and careful crossing. This was taken from 1900 on.

ce Mendel's researches, of such fundamental importance for cross-general, have come to light, the work in this direction at Svalöf is greatly enlarged. In particular, Dr. Nilsson-Ehle's researches in wheat and oats have furnished remarkable contributions to the study of the inheritance of this nature. The new light furnished on these problems of variation and heredity has been of considerable value for the improvement of agriculture. It seems that at last Sweden is in a position to produce agricultural plants for use in more northern latitudes; such varieties will combine good qualities with strong winter-resistance or marked rapidity of

growth. Further, the application of this method, which has been very much at Svalöf, has shown that the combination and segregation of qualities in the products of crosses is normally so complicated as to render very difficult the idea of reaching good results by theoretical speculations. But a difficulty that must be put up with, as crossing offers so many possibilities, even if they are rather vague, of results which cannot be had in any other way.

In any case, the crossing which we do at Svalöf with our already fixed varieties is to be considered primarily as a supplement to the older method, and not as a substitute for it. All crossing work demands as a starting point a stable material of well-known properties, so that the first thing to be done is to prepare such material. In the same way the subsequent development of the process of crossing depends on the continuous creation of new and improved material. Consequently, for the production of the two groups of varieties required, our method must be used, as it is the best and most reliable for seeking out the most valuable and constant types in the old varieties. It should also be remarked that selection among the variable descendants of a cross is practically exactly like the old method.

As a large and important part of the material dealt with, such as cereals and root crops, the time for crossing is still in the distant future.

Plants and successive development of the work. — The crops dealt with at Svalöf from the beginning are winter and spring wheat, rye, barley, peas; peas and vetches were started in 1889. Oats, however, were not introduced till very intensive work till the adoption of the new method in 1900, and rye not till 1900. It is true that the programme included the improvement of agricultural plants, but no attention was given to these till further progress was forthcoming; it was thus not till 1905, when the Government granted £1400, that it was possible to begin work on forage grasses, clover and lucerne. Root crops will not receive systematic improvement on the Svalöf method till after the coming rearrangement of the finances to which we have already referred. It is true that some work has already been done on them, but only by the simplest pedigree method, with selection of bulk. The time is now approaching when all agricultural plants dealt with by our Institute.

As mentioned above, the intensive study of details which the new method involved, led to a distribution of the material in which each specialist

received a separate section of work. Thus oats and wheat were under by me from 1890 to 1910, and since then have been under the charge of H. Nilsson-Ehle. Barley was under M. P. Bolin from 1892 to 1895; was succeeded by Dr. H. Tédin, who has also had charge of the leguminous plants since 1892. M. J. Walldén had rye from 1901 to 1904; then was joined by M. E. Ljung, who has had sole charge since 1908. M. Lundberg has had potatoes since 1905; forage crops were taken by 1904, but in 1907 were handed over to Dr. H. Witte, who at the same time undertook clover; root crops have been under M. J. Karlsson and since 1907. M. Walldén has directed the work of control and germination testing since 1892.

It is evident that the final results of our work can be of practical only under conditions similar to those in which it was undertaken should not be expected to be of value for very different soils and climates. In a country of the size of Sweden, which extends over 13° latitude, that is to say a north-and-south distance as great as from the coast of Sweden to Rome, it is evident that this rule necessitates a number of trial crops in the different parts of the country. After producing, at the Institute, situated in Southern Sweden, a good many varieties believed to be suitable for the centre of the country, we had every year to establish a number of such local trials. We soon found it necessary to have branch stations, so as to undertake more detailed research, and to have proper control of the distant trials. We already have two such stations: one established in 1894 in Central Sweden (near Upsala), and the other in the Arctic Circle at Luleå; the latter is especially concerned with crops. Owing to the present state of the work, we are intending to establish several more in the more important agricultural provinces.

Commercial collaboration. — Most of the men who had founded the Experiment Station, joined in 1891 to form the Swedish General Seed Company, this organization undertakes to look after the new varieties before they are produced, and to increase them and put them on the market, the whole being under the supervision and control of the Society. This commercial enterprise was at the outset confronted by many difficulties. But since the beginning of the present century, with the increase in number of the new varieties, it has shown continuous growth in importance and extent, so that it now has a very firm foothold and gives great help to the parent institution.

There are thus really two distinct organizations at Svalöf, connected with one another perfectly in the work for the common end. This is what is often confused abroad under the general name of Svalöf Institute, though they are perfectly distinct in both administration and ownership. The Company has purchased an estate next the Society's land, covering some 1500 acres of first class fields, where most of the field trials of the Society are carried out. There are also special stores built on the property. The Company also possesses two well-equipped branches in other parts of Sweden.

The detailed distribution of the work and the contracts between the organizations were approved by the Government in 1909, and are under supervision. According to this arrangement the Company takes the varieties as soon as they are ready, generally in amounts of only some lbs.; they are then increased on the land already mentioned, under the supervision of the specialists. The subsequent crops on a large scale, which really have to be carried out on the farms of proprietors in the different provinces, are also under the same expert inspection.

Not only the small élite progeny, but also the larger crops, are examined and approved by the Society when sent to the store; the Society also directs the cleaning and sorting, makes an exact analysis of each lot, puts its mark on the sacks and sees to the final dispatching, so that the purchaser receives each lot with a sufficient guarantee of its quality.

The varieties already handed over to the Company remain under the supervision of the Society, so that new lines, fresh blood in fact, may be introduced into the Company's strains as soon as required. In this way the Society remains always responsible for the purity of the varieties etc.

In return for these privileges the Society receives from the Company a certain annual sum, at present exceeding £2 200. Further the Company, under certain conditions, to hand over to the Society part of the surplus-profit. As the members receive only a limited dividend, it may be said that the Company also works exclusively for the public interest.

Svalöf products abroad. — It is evident that varieties selected and valued under a climate as northern and distinctive as ours can only be used to a very limited extent in countries with very different climates. But taking into account only the part of Europe north of the Alps, and leaving out the extremely continental climate of Central Russia and parts of Austria and Hungary, it seems that a good number of our varieties are suited to the conditions of other countries. Indeed they have already spread over a considerable area. It has happened that certain early ripening varieties, such as Hannschen barley and Culdregn oats, have unexpectedly adapted themselves to very extreme conditions. Thus, to give examples, the new varieties of oats are much grown and appreciated especially in Russia. Most of our varieties are much grown in Germany, Denmark and Holland, and in the last few years have been taken up in Sweden. In France the malting barleys are especially appreciated, but not the oats. In Canada and the United States a good many varieties are grown, but all limited to certain special regions. Further, isolated trials have been made almost all over the civilised world, under the most diverse conditions, with very varying results, as was foreseen.

Improvement of Wheat and Oats at Svalöf

by

H. NILSSON-EHLE.

Since 1900 the writer of this paper has been conducting the work plant breeding in the Wheat and Oats Section at Svalöf; he has published a series of memoirs and notes, some theoretical, others practical, on the subject. In the "*Beiträge zur Pflanzenzucht III*" the writer gives a résumé of his work on winter wheat. A similar summary, in German, of the work accomplished on oats, with complete bibliography, is in course of preparation.

The present article proposes to give the most important results of all this work. The chief object aimed at during these twelve years has been to provide farmers with improved varieties. Secondly, so far as time permitted, an endeavour has been made to develop further the principles and methods of practical breeding, by giving in a series of publications, partly of a purely theoretical nature, information on the basic principles of breeding, variation and heredity.

Practical breeding has resulted in a series of new varieties which have been handed over to practical farming, but only such varieties were distributed which in practical experiments yielded a heavier crop than previously grown or otherwise revealed themselves superior.

These improved varieties were selected only according to yield and to direct valuation of their good qualities, and *not* according to an indirect opinion based upon a supposed correlation. An increase in the number of varieties grown in Sweden was vigorously avoided: the new varieties were so distributed as to replace the varieties previously grown, and no great number of varieties were produced than those required by the very varied climatic and other conditions obtaining in Sweden. The most important new varieties launched between 1900 and 1912 are: among winter wheat, *Extra Squarehead II* (1909) (1) and *Sun wheat* (1911) for the South of Sweden, and *Poodle wheat* for Central Sweden; among oats *Conqueror* (1909) for the white oat districts of the South of Sweden and *Black Bell II* (1909) for the black oat districts of Central Sweden. All these varieties have been widely distributed during the succeeding years, not only in Sweden, but to a great extent in neighbouring countries also, and have retained their position in practical farming. Besides the above, some few varieties adapted to special conditions were distributed (*Fyrås* oats and others).

(1) The date in brackets is that of the year in which the varieties were first distributed upon the market and mostly in great quantities.

the new varieties have replaced the older ones: Extra-Squarehead II completely replaced Extra-Squarehead I, the yield of which was considerably inferior (about 15 per cent); the Grenadier variety is also destined to disappear gradually. As for oats, the varieties Hvitting and White Proboscis as well as Black Bell I formerly bred at Svalöf, have been withdrawn and are no longer sold at Svalöf. Thus an increase in the number of varieties has not taken place. A few other varieties which show further improvement in certain directions have been given out to be grown on a large scale and will within a very few years be placed on the market; thus among cereals an early cross for the North of Sweden, and among wheats a productive cross for South Sweden (0801) and Thule for Central Sweden. The multiplication of the most recent crosses, which represent the highest mark at present attained in improvement, is being carried out.

The above new varieties have been obtained partly by selection from existing cereals and partly—during the last few years principally—by crossing. By mutation, on the other hand, no new improved variety has been obtained. The artificial crosses were made with the object of combining in the best manner the principal valuable qualities, such as resistance to cold, diseases and diseases, productivity, and the like, and at the same time of directing these qualities in the desired direction. In the attainment of these aims continual progress has been made.

The work concerning the theoretical basis of breeding referred especially to the nature of the hereditary variation in cereals and to the manner in which several qualities, especially those of practical importance, are inherited. With this object the writer began in 1900, the year in which the discoveries of Mendel were known, comprehensive experiments in breeding; the results have hitherto been only partially published in the two annual works of the years 1909 and 1910, as well as in a series of shorter

communications. The first result of these researches agreed with those of Von Tschersky, Spillman, De Vilmorin, Howard and others, namely that the qualities of cereals, after crossing, show a sure segregation and recombination and form all kinds of combinations. The so-called elementary species, "constant forms," "pure lines" of the mostly self-fertilizing cereals are not, as De Vries thinks, independent entities created by progressive mutations, but various *homozygotic combinations* of segregating qualities. The crossing of two constant forms may give rise to an immense variety of new forms which may be maintained constant; it is thus to have only *one* such cross to render manifest all the diversity of constant forms or lines of a native breed. In other words, crossing of only two constant forms, a whole "population" of new forms and lines is obtained. As spontaneous crossing occurs frequently in self-fertilizing cereals the nature of the so-called elementary species as combinations of crosses becomes quite clear.

As this fact being recognized, artificial crossing became naturally a specially important principle in breeding. The object of breeding was no longer limited to the selection of the existing homozygotic combinations, but was extended

ded to the obtaining of always better combinations, by appropriate crossing; and in this connection not only the crosses between older and different varieties, but also between lines, partly of the same old breed.

As for the magnitude of the differences between the homozygotic combinations ("genotypes" of Johannsen), it was shown in connection with researches on the variation of native breeds (*Sveriges Utsädesföretag Tidskrift*, 1901, pp. 154-176; 1908, pp. 165-170; *Botan. Notiser*, 1909, pp. 113-140), as well as upon the segregation of qualities after crossing, that in respect of most qualities, especially of the practically important ones, the genotypes are so numerous and so closely connected that they form fully continuous lines; the result is that by cultivating separate plants of similar aspect, an apparently uniform group of individuals can be split up into different descendants, into lines hereditarily different. As to the genotypes one may, it is true, isolate well characterised "elementary species" from a native breed, but a more minute analysis of the native material reveals that they are connected with each other by the finest transitions and the differences are only in the rarest cases of a qualitative "botanical" nature, and this especially for those qualities with which practical breeding deals. Further, in quite similar morphological types the physiological characters most important in breeding, such as productivity, resistance to disease, lodging and cold, early maturity and the like, may be essentially different. In consequence of this, "separation by lines" instead of "separation by forms" was introduced in the years 1901-03. Instead of selecting out from old strains a relatively limited number of morphologically characterised forms and fixing them by continued selection, while further improving them by utilizing the new variations which appeared, as had been done until then at Svalöf also, further improvement in this direction was abandoned because no good results had been obtained (1); in its place a more extensive improvement of old varieties was resorted to, by selection for separate cultivation from each variety to be bred, the greatest possible number, sometimes several hundreds of plants, without caring whether their outer appearance was the same or not, and their descendant lines compared as to their production and practical value. From these descendants or lines the best were finally picked out. A further selection for better fixation of the characters of the finally selected lines was not made, because with this separation of lines from old breeds of most self-pollinating cereals the lines in general were already sufficiently fixed. This is explained by the fact that by continued selfing only the homozygotic combinations can be maintained in the long run, as Mendel had already shown.

The descendance resulting from crossing was treated in a similar manner, only the separation of lines was frequently repeated. In this method of separation by lines all the new improved varieties have been bred.

(1) Further improvement was sought for by means of suitable crossing.

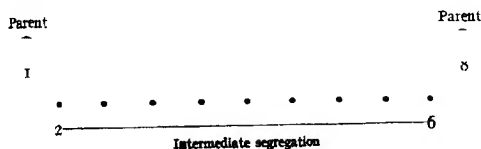
In the attempts made to obtain desired combinations from crosses, it must be noted in the first place that most of the practically important characters are very probably exceedingly complex "construction characters" (Konstruktionseigenschaften). After crossing two constant forms which represent two degrees of a character, e. g. size, resistance to frost or cold, time of maturing, the segregation is always complicated and can only be ascertained by the separate cultivation of all the F_2 plants by the comparison of the average characters of their offspring in F_3 . With regard, for instance, to the medium height of plants, the constant plants vary very much; there are taller and shorter lines in a whole series of degrees which could be represented by:

1 2 3 4 5 6 7 8 9 10.

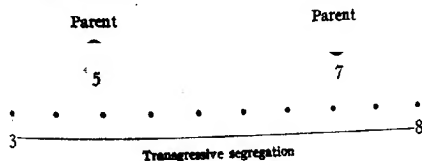
Crosses between any two tall and low constant lines do not give (or in the rarest cases) the simple Mendelian segregation. The segregation does not take place in the following manner:

as 1×8 , F_2 : $\frac{1}{4}$ homozygote 1, $\frac{1}{2}$ intermediate heterozygote, $\frac{1}{4}$ homozygote 8.
 1×5 , F_2 : $\frac{1}{4}$ homozygote 1, $\frac{1}{2}$ intermediate heterozygote, $\frac{1}{4}$ homozygote 5.
 5×8 , F_2 : $\frac{1}{4}$ homozygote 5, $\frac{1}{2}$ intermediate heterozygote, $\frac{1}{4}$ homozygote 8.

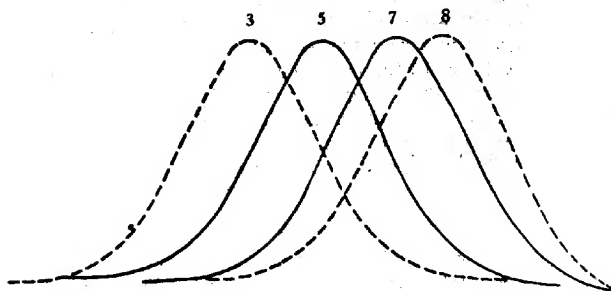
On the contrary, the segregation after crossing for instance 1×8 shows a whole series of gradations, among which those of the parents are rare or may be completely wanting, so that the whole segregation is intermediate and does not attain the limits given by the parents:



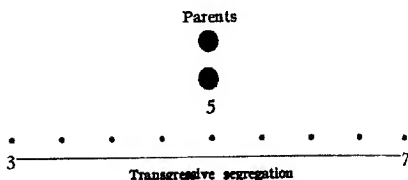
Inversely, when two medium slightly different lines, such as 5 and 7, are crossed with each other, the segregation is very often, and sometimes considerably, *transgressive*, that is degrees appear which exceed the limits of the parents in one or in both directions; lines are formed which on the average are taller or shorter than their parents and which on further cultivation show that they possess this character as a true hereditary trait:



As every hereditary line shows certain fluctuations in its modification which can sometimes be very considerable, the transgressive segregation might perhaps be better represented as follows:



The fact is also important that lines that possess the same degree of character give on crossing segregations which form transgressive lines



This is the manner in which all the quantitative practically important characters that the writer has investigated in wheat and oats behave, such, for instance, are the degree of resistance to cold (cf. *Zeitschrift für Pflanzenzüchtung*, Vol. I, 1912, pp. 3-12), early maturity (cf. *Compte rendu de la IV conférence intern. de génétique à Paris*, 1911, pp. 136-Paris, 1913), resistance to rust and to lodging, productivity, size of grain. The extensive researches of Tedin on barley (short notice in *Popular genet. Revy*, 1912, p. 216) show many quite similar results, in regard to early ripening, degree of emergence of the ear from the sheath, and so forth. Sometimes the transgressions after the crossing of constant line medium characters are very considerable (e. g. the time of ripening of grain).

On the basis of all the facts, agreeing for several characters, and concerning the behaviour of segregation not only in F₂ but also in the following generation (in F₃), it is to be noted among other points that the segregation in certain descendants is considerably greater than in others. The writer has suggested the theory that all practically important characters are of a complex nature ("Konstruktionseigenschaften") determined by many Mendelian factors, which through various combinations, form the series of hereditary constant gradations.

The writer starts from the behaviour, which in principle is quite the same as that of other characters, which submitted to the analysis of crossing have revealed themselves undoubtedly polygenous, that is determined by several Mendelian factors.

The most important are the factors which operate in the same direction (gleichsinnige Faktoren); a character, e. g. the red colour in wheat, may be built up by several factors, each of which has the same exterior effect, and each of them possesses the power of determining the appearance of the character. (For this phenomenon Lang proposed the name "polymer" and Plate that of "homomery"). The black colour of the glumes may be determined by two factors, instead of by only one as is usually the case. Then in F_2 the segregation 3 black: 1 white according to the simple Mendelian scheme does not take place, but instead the segregation 15 black: 1 white. There are two black factors, A and B , each of which is capable of producing the black colour. After crossing with a white variety ($AB\ ab$), a black F_1 plant is formed, which produces the four kinds of gametes AB , Ab , aB and ab ; from the 16 combinations of these gametes only one ($ab\ ab$) will be white, because all the combinations in which either one or both of the factors A and B enter will be black. A ratio of 15 black: 1 white in F_2 is thus produced, as may be seen in the following figure:

| ♀ | AB | Ab | aB | ab |
|------|------|------|------|------|
| AB | 1 | 2 | 3 | 4 |
| Ab | 5 | 6 | 7 | 8 |
| aB | 9 | 10 | 11 | 12 |
| ab | 13 | 14 | 15 | 16 |

Of the 15 black F₂ plants 7 (1-7) remain constantly black in F₃ (8-11) segregate again in the ratio 15 black : 1 white, and 4 (12-15) in ratio 3 black : 1 white.

Segregation follows the same law when three factors operating in same direction are present, as in the red colour of the grain in wheat. Crossing of a three-factor red line, *ABC*, with a white one, *abc*, produces in F₁ plant eight kinds of gametes *ABC*, *ABc*, *AbC*, *aBC*, *Abc*, *aBc*, *abC*, and *abc*. Of the 67 possible combinations 63 are red and only one (*abc*) is white. In F₂ the ratio is 63 red : 1 white and in F₃ it obeys the law as expected.

When four factors in the same direction are present, the ratio is 255 : 1; the writer considers it highly probable that this is the case in the ligule character in oats.

In the crosses of two lines, each of which possesses an independent factor operating in the same direction (*Ab* × *aB*), the offspring will in some combinations in which both factors enter and others in which one is absent. Through crossing two red-grained wheat lines which had the same appearance, the writer obtained in F₂ the segregation 15 red : 1 white and in F₃ the further segregation as expected. (*Berichte der deutschen botanischen Gesellschaft*, 19, 1911, pp. 65-69):

| | | | | |
|-----------|-----------|---|-----------|-----------|
| | red | | red | |
| | <i>Ab</i> | × | <i>aB</i> | |
| red | red | | red | white |
| <i>AB</i> | <i>Ab</i> | | <i>aB</i> | <i>ab</i> |

In the same way the crossing of two very similar common oats of them possessing a factor for spreading branches (*Ab* × *aB*) produce in F₂ and F₃ the one-sided oats (*ab*) as well as forms (*AB*) with branches more divergent than in either parent, as expected.

In this manner apparent novelties, apparent mutations, arise.

The writer has found factors having the same direction in determining numbers, in a series of quite different characters of wheat and oats only in the colour (of the glumes in oats, of the ear and grain in wheat) but also in the size and form (length of the internodes in the ears of wheat, type of panicle in oats) (1), as well as in several other characters (position of ligule in oats).

Factors in the same direction are often cumulative, that is, their effect adds up, so that the character is more strongly impressed the greater number of factors present. By means of several combinations of the factors, especially when heterozygotes are taken into consideration, a continuous variation of a hereditary nature may arise.

(1) The common oats possess several factors in the same direction for determination of the branches; on crossing with Tartarian oats (*Avena orientalis*), the common oats in F₂ do not amount to a quarter of the individuals, but to a much larger portion.

the above-described behaviour of the practically important characters (resistance to cold, rust, etc.), giving intermediate and transgressive segregation, is easy to understand by means of the theory of several factors working in the same direction and of a cumulative nature. Already with four factors, on crossing the extremes ($ABCD \times abcd$) these extremes will be obtained only once each in every 256 individuals; all the other 254 individuals are intermediates; in a limited number of individuals the whole segregation is intermediate. The individuals of medium character will be the most numerous, because the gametes with medium number of factors (two factors) are the most numerous. By means of the curve of combinations (Kombinationskurve) of several factors operating in the same direction the original curve of frequency of hereditary variation is at least partially changed (1).

The transgressive segregation of practical characters after crossing intermediate constant lines is to be attributed to the presence of several factors operating in the same direction in these lines, in the same way as crossing of two similar red lines ($Aa \times aA$) gives rise to partly deeper red (AA) and partly white (aa) as transgressions.

The principle of the action of several factors in the same direction is, for practical breeding, the principle of the work of continuous variation.

In winter wheat, the object aimed at is to combine always in a better way the probably many inner factors which determine the practical characters of productivity, resistance to cold, to diseases and to lodging, and little by little good progress has been achieved in the desired direction (see above), even if the chief aim of the work, namely to unite productivity and other characters of the best West European varieties with the resistance to cold of the native Swedish varieties, is still far from being attained.

Further, an endeavour is made with both wheat and oats to obtain an increase in productivity by crossing two varieties, equally productive, in which might eventually be the combination of several factors. In this direction some results have already been obtained, with winter wheat (Cf. *Uppsådes förenings Tidskrift*, 1912, pp. 317-318) and with oats (result not yet published).

The principle of continued combination work in practical breeding is based only on the principle of factors operating in the same direction, in general on the multiplicity of the inner factors which determine the characters, and the complexity of the segregations caused by it. When only one factor working in a particular direction (e.g. for black seeds in oats) is present and in F_2 the segregation is 3 black : 1 white,

By the term "Combination" German writers (Baur, Schinz) mean a variation obtained on the one hand by segregation of hybrids and on the other by new combinations of "hereditary units". Cf. BAUR, ERWIN: *Einführung in die moderne Vererbungslehre*, 1917. Berlin, 1911.

the segregation is by no means simple, because the black homozygote may show very various shades of black, which points to the existence of modifying factors (reinforcing or inhibitory factors). A similarly no segregation is very frequent in several characters of wheat, as well as in oats; the writer is conducting special experiments for the investigation of this question. He has recognised quite special inhibitory factors in wheat and oats (*Zeitschrift für induktive Abstammungs- und Variationslehre*, 5, 1911, pp. 1-37), and it is very probable that these inhibitory factors also are not simple, but series of factors, and that there may be inhibitory factors operating in the same direction.

Considering this multiplicity of inner factors and the consequent slowness of improvement — though it may be slow and gradual — by the combination of these factors, the writer has come to the conclusion that together with the selection of already existing combinations, systematic artificial continuous crossing will in the near future play the most important part in plant breeding.

The writer has several times recognised spontaneous variations in homozygotic lines (*Zeitschrift für induktive Abstammungs- und Variationslehre*, 5, 1911, pp. 1-37; *Verhandlungen des Naturforscher Vereins in Brunn*, 50, 1911, pp. 139-156). These spontaneous variations are due to the disappearance of Mendelian factors (mutations by loss). Nothing new has been produced in the cases hitherto observed. Nevertheless, the writer considers it not impossible that there may be mutations by loss which will prove valuable to breeders. For the investigation of this question also the writer has extensive experiments in course.

DETAILED PUBLICATIONS ON THE BREEDING WORK OF THE WRITER

NILSSON-EHLE. 1. Ueber die Winterweizenarbeiten in Svalöf in den Jahren 1900-1912. (Work on winter wheat carried out at Svalöf from 1900 to 1912). — *Botanische Pflanzenerziehung*, III, pp. 60-86. Gives a complete list of the writer's 31 put on wheat.

2. (Experiments in crossing oats and wheat). — I. *Lunds Universitets Årsskrift*, 1909, N. F. Afd. 2, Vol. 7, No. 2, pp. 122. — *Ibid.*, 1911, N. F. Afd. 2, Vol. 8, pp. 84.

3. (Annual Reports on the work on oats and wheat at Svalöf). — *Uppsala Universitets Årsskrift*, 1906-1912.

The Present State of Motor Cultivation in Germany

by

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Farmers who possess large extents of heavy soil can use to advantage the double-engine system of steam ploughing in which a balance plough is hauled by a wire rope alternately by each engine. The increase



Fig. 1
Stock's plough.

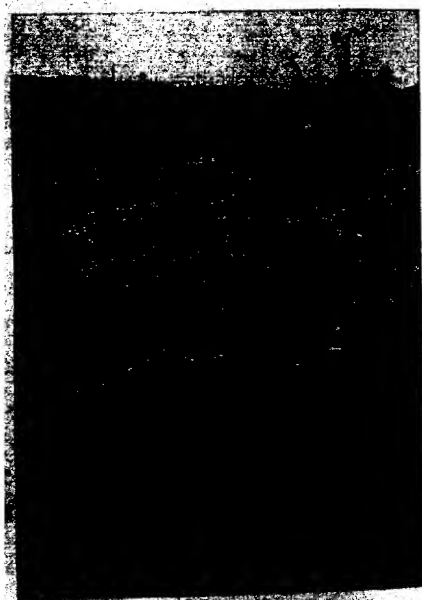


Fig. 2
Stock's plough with harrow.

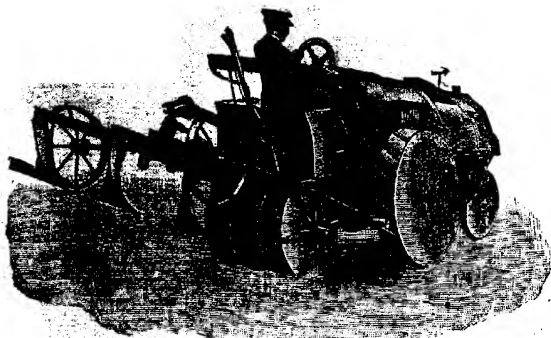


Fig. 3
Gustav Pöhl's motor plough.



Fig. 4
Motor plough of the International Harvester Co.

number of farms in Germany which use steam ploughs, namely from 836 in 1895 to 2995 in 1907, shows that the need of mechanical aid in the tillage of the soil has steadily increased and that at the same time the machine industry has satisfactorily met the demands made upon it. But the figures for 1907 are exceedingly small in comparison with the total number of farms. In fact they represent only a little over 10 per cent. of the farms covering upwards of 250 acres. All the other farms had to plough the land in that year and the three following years with teams, because electric outfits that were used in some few farms might have been counted on the fingers of one hand.

At the same time the want of a cheap, mobile, mechanical plough, adapted to small farms and to the shallow tillage of light soils, was all the more keenly felt as the conditions of labour grew worse and the advantages of careful tillage were more universally recognized. The hope that the use of oil engines would soon solve the difficulty, which the cumbersome steam engine could not, seemed at first impossible to be realized, and several eminent engineers considered the problem of motoculture as an insoluble one. But the laborious and expensive experiments of Robert Stock, a man who had much practice in mechanical technique and who had learned, on an estate he had then bought, to appreciate the difficulties of tilling the soil, resulted in a practical solution of the problem. In the spring of 1910 he was in a position to put before the public the first motor plough.

With a few unimportant modifications, several hundreds of Stock's motor ploughs are now used and, under suitable conditions, work satisfactorily. These ploughs weigh between 4 and 4½ tons. They are so constructed that almost the whole of their weight is carried by the driving wheels, thus producing the necessary friction between the wheels and the ground. The wheels are 7 ft. 4 in. in diameter and only 6⅓ inches wide; they are furnished with lugs which project on both sides about 4 inches beyond the tyres of the wheels, so as to allow sticky soil to fall off easily. The lugs are not arranged transversely, but somewhat inclined, so that they penetrate into the soil obliquely, thus ensuring against skidding and facilitating their coming out of the ground. In order to utilize to the greatest extent the weight of the machine on the driving wheels, the four-cylinder benzine motor is situated well in front so as to counterbalance the heavy shares with their frame placed at the back. The steering wheel at the tail of the machine bears thus a very small part of the weight.

Stock's plough met with great success for its several good points. It is simple in construction, for the motor and the implement form a single and visible whole. Nor is its working less simple. The driver sits in a light seat, with the steering wheel, the crank for regulating the depth of the shares, the levers for driving the motor close to his hands; by means of one lever the motor is thrown into gear and by another one the regulator of the depth is disconnected. The machine is further simplified by there being no device for reversing or for changing its gear when once started at a certain pace. This simplicity, however, is attained at the expense of

some advantages. The change in speed can only be obtained by changing the gearing, which can only be done when the machine is not working and besides requires a certain amount of time.

A test of Stock's plough made by the writer in 1911, on behalf of the Colonial Committee, gave the following results as to work done and consumption of fuel (1). On a mild loamy sand the motor plough worked at 1.73 acres in one hour to a depth of 6 $\frac{1}{2}$ inches. The field was 700 y long and of a convenient shape. Another day 1.48 acres per hour, ploughed to a depth of 8 $\frac{3}{4}$ inches. Lastly, in consequence of several stoppages due to the field not being sufficiently dry, only 0.99 acre ploughed per hour to a depth of 7 $\frac{1}{4}$ inches. The consumption of benzene was under the favourable conditions of the first day only 12.3 lbs. per acre but on an average in practice it ranges from 14.3 to 19.6 lbs. per acre. Power developed, as registered by a brake dynamometer, was 33.9 H.P.

The technical success of this machine was a stimulus to other inventors to similar attempts and to further improvements. Most of them consist in the want of the means of changing the speed, and especially of reversing, as disadvantages, and it must be recognized that this is true. On a level and uniform ground a change of speed is not necessary, but on slight undulations or depressions are to be traversed it is a drawback to have to keep up the same slow pace that has to be taken for going up according to the power of the motor. Still more important is reversing, for as soon as the plough is brought up by a big stone, or through a skid error of the driver by any other obstacle, the machine generally requires the assistance of horses to shift it; while if it could back it could disengage itself. Recently, the firm Stock has been providing its plough with reversing gear if demanded.

Since 1910 a number of motor ploughs have been invented, but only a few of them have survived, and deserve to be mentioned. Very similar to the Stock plough is the Wandeler-Dohrn plough of the German Motor Plough Co. (Deutsche Kraftpflug Gesellschaft); but it has reversing gear and two speeds, and its management has been cleverly simplified. The shares are fastened to a special frame which can be easily lifted and lowered being fitted into a main frame.

The machine of the Gast Motor-plough-building Co., Ltd. (Gast Motorpflugbau G. m. b. H.) in Berlin (2) is very light. Both the tractor and ploughing outfit are mounted on spring frames. The tractor weighs about 2 $\frac{1}{4}$ tons. The Gast plough has reversing gear and various speeds ranging from 2.8 to 5.3 miles per hour. The separation between the motor and the ploughs which has been made in this machine has been followed by most builders. It facilitates the use of harrows, mowers, root lifters and similar machines, and is absolutely required by many farmers. At

(1) *Verhandlungen der Kolonialtechnischen Kommission des Kolonial-Wirtschaftsausschusses*, 1911, No. 1, p. 41 et seq., No. 2, p. 62 et seq.

(2) Since the above was written the Gast Co. has been wound up. (Author's note.)



Fig. 5.
Heinrich Lanz's revolving-hoe ploughing machine.

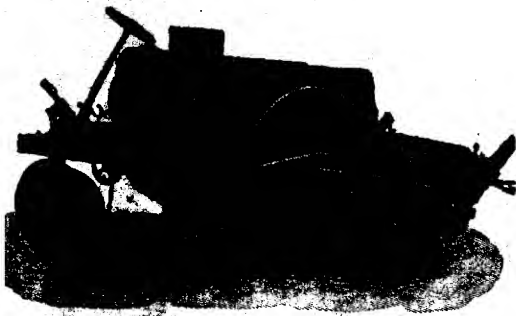


Fig. 6
Meyenburg's motor tilling machine

time it must be recognized that the unity of construction of the Stock plough is one of its principal merits, because, setting aside all secondary considerations, it is built exclusively for ploughing. Besides, those who use Stock ploughs have already devised methods for attaching other implements instead of the plough shares.

Of quite special build is Pöhl's patent motor plough, devised by Gus-Pöhl, of Gossnitz (Saxe-Anhalt); this carries in front of every plough a revolving coulter, consisting of a sharp disk with projecting blades which have the object of easing the work of the plough by breaking up the soil and thus diminishing its resistance.

This feature makes Pöhl's plough resemble somewhat those machines (Landbaumotoren) which till the soil not by means of plough shares but by using hoes. Among these the one that has been most tested is the one invented by the Hungarian Kőszegi, the building of which has been undertaken by the firm Heinrich Lanz, of Mannheim. Lanz's machine has now assumed a form so different from Kőszegi's original, that only the manner of working has remained the same. The driver sits on a three-wheeled vehicle resembling a motor car and controls the whole machine. The shaft, to which the disks that bear the cross-blades, is situated at the hinder end and is driven by an endless chain; it can be raised or lowered by the driver by means of a hydraulic apparatus.

Somewhat similar is the v. Meyenburg's "Landbau motor" of the Landkultur Joint Stock Company, Bielefeld, built by the Siemens-Schuckert works. It differs from the Kőszegi machine chiefly in the elasticity of the shares, which are not of rigid sheet iron, but consist of curved claw-like steel strips. The advantage of the elastic hoes is claimed by the inventor to be in their being able to avoid stones and other dangerous obstacles, and consequently to last longer than rigid hoes and to require less power.

The experience gathered as to these revolving disk machines is as yet insufficient to pronounce final judgment upon them. As indeed none can be pronounced upon motor ploughs, in spite of the fact that these are found in much greater numbers. Present experience shows that the revolving disk machines require more power than motor ploughs. On the other hand the work they perform is more intense, since they work the soil like tilling machines and reduce it to a fine tilth. They accomplish at once without requiring any further assistance, what frost and changes of weather would render ordinary ploughing. Such a finished tilling is well worth a few pounds of benzine, and it would be unjust to make capital of this greater consumption against these machines. Possibly Meyenburg's machine, owing to its elastic hoes, may be made so much lighter than motor ploughs that saving in weight will bring about a notable saving in power, as the work consumed in running the machine varies with its weight. But just this machine is one of those that has been tested least. It is proposed to build it in various sizes down to 8 H. P., and in breadths ranging, according to the depth of the work, from 32 to 56 inches.

The reason for the more favourable conditions, at least in theory, of the revolving tilling machines as compared with those of the motor

ploughs, lies chiefly in the fact that their working disks revolve in the same direction as the driving wheels and that while working they propel also at least even in the most unfavourable conditions they do not act as but as plough shares do. The fear that the finely divided soil would soon be compressed again has in no case been justified. Manures and stubble distributed throughout the tilled layer, and only in soils overrun with couch grass are unfavourable results to be apprehended from the probability of increasing the infestation by the couch grass being cut up into many small pieces. From the point of view of tillage there are hardly any objections to be raised against these machines, but their technical execution is not yet quite satisfactory. For this reason Meyenburg's machine is not yet on the market, and Lanz has had some lack of success with his machine, in 1912. On a heavy soil it did not work beyond a certain depth, because the motor, in spite of its 60 H. P., was not strong enough to level the surface of the ground was left uneven in the wake of the machine on to unequal depth of work, due to the disk shaft not being properly supported. Both inventors are actively occupied with the improvement of their machines. Lanz's machine in a modified form has already worked very well this spring.

For soft soils such as moors, most motor ploughs are too heavy. This is especially true for American machines, which work satisfactorily on most other German soils. They are all built on the tractor system to facilitate hauling other implements besides ploughs. The ploughs are so arranged in the American machines that a man can stand on a kind of platform and regulate the depth of the shares while the machine is running. In some machines each ploughshare is independent and yields if an obstacle is encountered; in others they are united in groups, as in the Moline Plow Company plough, in which they are in two groups of four. For greater depth of work (8 inches and upwards) American builders prefer disk ploughs. It is true that these do not leave the bottom of the furrow smooth, but they penetrate easily into the soil even under difficult conditions, as for instance when long stable manure has to be ploughed in.

American tractors have no very projecting grips on the tires of their wheels, which are very broad, but only low obliquely set lugs. The frequently used tractor of the International Harvester Co. (Thacker & Co. tractor), in its largest size, has hind wheels 6 ft. 4 in. in diameter and 24 in. wide, which can be further widened by additional tires 14 inches wide. Its motor is about 45 H. P., and its weight 9 1/4 tons. The form of the wheels is well adapted to hard soils, and allows of the machine passing over the fields to hard soils without being obliged to unscrew the grips or put fenders between them to prevent their being damaged, as is the case with Stock's plough. But on soft soils the wheels have not enough grip, and they begin to skid in places where Stock's plough continues to go all right. The great weight of the machine is also a difficulty in soft soils. As the tractor engine the machine can naturally be used without any alteration.

In order to work with motor ploughs on moors, recourse must be had to haulage with steel ropes, but instead of steam engines, oil motors

as smaller power is sufficient. Hartmann, of Berlin, builds his plough on a one-engine system, and fixes the drum on which the tail rope is paid on an iron carrier mounted on rollers which is anchored in the ground. In Neukirch's system (Löcknitz engine works) there are two portable engines, each of which drives one drum which alternately hauls the cable moving the plough and the cable anchored at the other end which serves to move the engine forwards. The experiments carried out with the Neukirch plough on the Pomeranian moors have yielded good results.

The results hitherto obtained with motor ploughs in Germany do not warrant a final judgment being passed on them, but they have confirmed for light and medium soils some very useful machines exist. Gradients of 1 in 10 offer considerable difficulties, because the machines require their own propulsion so much power that not enough is left for actual work. Stones also, when they are numerous and big, are a serious hindrance. Many American ploughs have safety appliances in the shape of iron pegs which break when the plough runs against a large stone, and share and the beam pivot round. But when there are many stones the pegs break so often that the amount of work done is diminished. On heavy soils the American tractors work best, while on soft soils ploughs of the Stock type are preferable. Depths of work reaching to 8 or 10 inches can be obtained on most soils; greater depths are not so sure. Disk ploughs do not penetrate more easily to considerable depths than the others; even Stock's ploughs have reached, according to the statements of practical men, as much as 12 to 14 inches and even 15 $\frac{1}{2}$ inches. I give these results, however, with reserve.

The amount of work done by a motor plough may be set down at an average of $1\frac{1}{4}$ to $1\frac{1}{2}$ acre per hour; on heavy soil and with deep work it falls to about 1 acre. The consumption of benzine, kerosene or benzol is, under average conditions, 3s 11d to 5s 7d. Benzol costs 15s per cwt. It does not work so cleanly as benzine which after combustion leaves little residue, but is dearer. Unfortunately the prices of liquid fuel have recently risen and are much less steady than those of coal, which is besides cheaper for the same amount of power developed. These data bring an element of uncertainty into the calculation of the profitability of these means of ploughing, and still more is this the case with the figures representing wear and tear and repairs. The data supplied by practical men vary within very wide limits; motor ploughs are still too recent to allow of their ability being determined. Several owners have already had to pay considerable renovation expenses. It is usual to calculate for interest, amortement and repairs 25 per cent. of the purchase price, which amounts for Stock's and similar ploughs to about £830, for the large Ihacé ploughs £30 and for the smaller ones £735. Such figures will have to be reckoned high, even with good and well schooled drivers, because the machines have to work under unfavourable conditions and the quick-running motors (Stock 720 revolutions) soon wear out. Ihacé has a motor that makes only 335 revolutions, but it appears doubtful whether its construction equals that of German motors.

Within the next few years the question of profitability will be taken up. In the meantime it is certain that for the shallow and moderate deep ploughing of the light and medium soils so prevalent in Germany motor ploughs assist very materially by the careful and seasonable tillage which can be done with them, and in overcoming the difficulties which unfavourable labour conditions oppose to the increase of the total yield of crops.

Report on the Diseases observed at the Phytopathological Laboratory of the National Museum of Rio Janeiro

by

ANDRÉ MAUBLANC,

Chief of the Laboratory

With the exception of some investigations concerning the most important economic plants, chiefly coffee, it may be said that phytopathology has been hitherto much neglected in Brazil. Certainly some naturalists have collected abundant material which allowed an idea, though a somewhat incomplete one, to be formed of the especially mycological flora of the country; but this material has for the most part been studied in Europe, and the specialists who dealt with it could direct their researches beyond the morphology and the system of fungi on cultivated and spontaneous plants.

Since its foundation, still quite recent (1910), the Phytopathological Laboratory of the National Museum of Rio Janeiro has been obliged through lack of proper installation, to limit its efforts to the scientific determination of the diseases which it examined; but the definite organization of this Laboratory, which is now an accomplished fact, will allow of more exhaustive phytopathological researches being made: of dealing with biological questions, which are the most important for the practical conclusions which may be drawn from them as to treatment.

Still, even now it appears to me to be interesting to state briefly which are the most important and most widely spread parasitic fungi on cultivated plants in Brazil, almost exclusively in the Southern States from Rio de Janeiro to Rio Grande do Sul, the only region from which the Laboratory has sufficient material. This information may be of real importance, as it is only by the comparison of similar statistics published in the various countries that an exact knowledge will be acquired as to the distribution of the principal diseases, and this seems indispensable, if it is intended by an international understanding to arrive at legislation capable of reducing to a minimum the danger of introducing into a given region diseases which are still unknown to it.

COFFEE. — The coffee plant, which is of capital economic importance in Brazil, is, especially in the State of São Paulo, almost immune from parasites of any importance. Certainly the leaves present some spots caused by various fungi: *Cercospora coffeicola* Berk. and Cooke (the most prevalent species), *Sphaerella Coffeae* Noack, *Colletotrichum coffeanum* Noack, *Stilbum flavidum* Cooke, and *Phyllosticta coffeicola* Spag.; these latter are confined to some moist localities of the coast belt and are known in the great plantations of the interior. None of these fungi are really dangerous and their effects can not be compared to those caused by unfavourable climatic conditions and especially by the cold winds from the south, which sometimes lead to the drying up of the branches.

Some cases of rot are also to be mentioned; they are due to a fungus which has not yet been determined, and have been found in the State of Minas Geraes; but they are purely local cases.

SUGAR CANE. — This crop, also very important, does not suffer from dangerous diseases in Brazil, at least in the greatest number of plantations; only rare cases can be mentioned of the appearance of disease: to *Colletotrichum falcatum* Went. (morve rouge) and to *Thielaviopsis paradoxa* (de Seynes) v. Höhn (pineapple disease). *Leptosphaeria Sacchari* Breda de Haan and *Phyllosticta Sacchari* Speg. cause only insignificant injury to the leaves.

TOBACCO. — Tobacco leaves often bear spots due to *Cercospora Nicotianae* Ell. and Ev., and also other spots the causes of which are not yet known: they do not seem to be due to parasites and are often designated by the vague name of "rusts".

MAIZE. — Only maize rust (*Puccinia Maydis* Ber.) has to be mentioned, but it is of no great importance.

MATÉ. — A great number of fungi, especially on the leaves, but seemingly not dangerous, have been noticed by Spegazzini on Maté (*Ilex paraguariensis*), a plant of the greatest economic importance in the south-western States of Brazil. I have recently had occasion to study the leaves of this shrub, on which I have recognized the presence of the following species: *Phyllosticta Mate* Speg., *Cercospora Mate* Speg., *Colletotrichum rubae* Speg. and *Pestalotzia paraguariensis* Maubl. (description not yet published).

RICE. — Only *Piricularia Oryzae* Cav. is to be named.

COTTON. — The leaves of cotton are frequently attacked by *Uredo gossypii* Lagerh. and *Cercospora gossypina* Cooke. A more serious disease is "fruit rot"; it is imperfectly known and doubtless due to the action of bacteria introduced by the punctures of insects.

VINE. — In the south of Brazil, vines have suffered from the following diseases: *Cercospora viticola* (Ces.) Sacc., the most frequent species, when widely spread producing a serious disease; anthracnose (*Gloeosporium ampelophagum* [Pass.] Sacc.), very frequent; powdery mildew (*Uidium Tuckeri* Berk.); mildew (*Plasmopara viticola* [Berk. et Curt.] B. et de Toni); *Coniothyrium Diplodiella* (Speg.) Sacc., form on leaves

hitherto very rarely observed; *Septoria ampelina* B. et C.; *Colletotrichum ampelinum* Cav.; *Pestalozzia uvicola* Speg.

WHEAT. — On wheat, in the south of Brazil, smut (*Ustilago Tri* Jens.) has been reported, and especially the rust, which, according to samples received, is due to *Puccinia glumarum* (Schm.) Eriks. et Her in one case only was I able to ascertain the presence of *Puccinia graminis* Pers. occurring with the preceding species.

FRUIT TREES. — The following list includes the parasites observed up to the present:

Guava tree: *Puccinia Psidii* Wint. (on leaves and fruits); *Gloeosporium Psidii* Delacr.; *Pestalozzia Psidii* Pat.

Mangoes: *Gloeosporium Mangae* Noack. (on the fruit); *Gloeosporium Mangiferae* Henn. (on the leaves).

Bananas: *Gloeosporium Musarum* Cooke and Mass.

Citrus fruits, various: gummosis; *Colletotrichum gloeosporium* Penz.; *Septobasidium albidum* Pat. (on the excreta of scales).

Jaboticabeira (*Myrciaria Jaboticaba*): *Uredo Rochaei* Puttem.; *Oidium Rochaei* Putt.

Fig: *Uredo Fici* Cast. and *Phyllosticta sycophila* Thüm.

Papaw: *Sphaerella Caricae* Maubl. (very frequent in its conical form *Asperisporium Caricae* [Speg.] Maubl.).

Cambuca (*Eugenia edulis*): *Uredo Cambuciae* Henn.

Peach: *Monilia fructigena* Pers. and *Cladosporium carpophilum* Thi

Apple: *Gloeosporium fructigenum* Berk. and *Macrophoma malorum* (Berk.) Berl. et Vogl. (on fruit).

Pear: *Gloeosporium fructigenum* Berk.

Quince: *Gloeosporium fructigenum* Berk.

Plum: *Puccinia Pruni-spinosae* Pers.

Japanese plum (*Prunus trifolia*): *Gloeosporium fructigenum* Berk. and *Monilia fructigena* Berk.

VEGETABLES.

Cauliflower: *Alternaria Brassicae* (Berk.) Sacc. This species, studied by M. Pattenmans, has caused serious damage, attacking the leaves and the flowers in the State of Rio de Janeiro.

French Beans: *Colletotrichum Lindemuthianum* (Sacc. et Mag Br. et Cav.; *Uromyces appendiculatus* (Pers.) Link.; *Oidium erysiphe* Fr.; *Isariopsis griseola* Sacc.

Peas: *Oidium erysipheoides* Fr.

Tomatos: *Septoria Lycopersici* Speg. (very frequent species).

Carrots: *Macrosporium Carotae* Ell. et Langl.

Asparagus: *Cercospora Asparagi* Sacc.

Celery: *Cercospora Apii* Fres.

ORNAMENTAL PLANTS.

Roses: *Phragmidium tuberculatum* Muell.; *Sphaerotheca pannosa* (Wallr.) Lév. (conidial form); *Marssonina Rosae* Br. et Cav.; *Cercospora rosicola* Pass.

Carnations: *Heterosporium echinulatum* (Berk.) Cooke.

Dahlias : *Oidium* sp.

Begonia Rex : *Oidium Begoniae* Puttem.

OAK. — *Oidium alphitoides* Griff. et Maubl. The appearance in 1912 of this dangerous parasite is interesting ; it dates from the month of August 1912, when oak mildew was observed by M. Puttemans in the gardens and parks of São Paulo ; somewhat later I recognized its existence in Campinas and since then the disease has made much progress.

Lastly fumagine is very widely spread on the leaves of a great number of plants (Aurantiaceae, coffee plants, etc.), where it is the consequence of the attacks of scale insects and aphides.²

The preceding list does not claim to give a complete picture of the diseases existing in Brazil ; it has been drawn up with the assistance of the documents possessed by the Phytopathological Laboratory of the National Museum, leaving out those species which do not present any special interest, either because they attack wild plants, or because they do not cause any serious injury to cultivated plants. On the other hand a number of specimens preserved in the collections of the Laboratory have not been completely studied owing to want of time ; this study is being pursued at present and it may already be stated that a great number of parasites — the description of many of them has not yet been published — might be added to the above list.

Further, for instance at São Paulo, several fungi have been reported, some of them injurious to cultivated plants (*Phytophthora infestans*, *Monophara cubensis*, etc.), which do not appear in the above list. It would have been easy to lengthen it with the help of bibliographical data, but I wished to mention only those diseases which had been observed in the Phytopathological Laboratory of the Museum, and the specimens which are preserved in its collections, thus allowing the determinations to be controlled.

SECOND PART. ABSTRACTS

. AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

624 - **Project Relating to an Official Register of Selected Plants in Hungary.**
Köztud. Year 23, No. 32, pp. 1153-1155. Budapest, April 26, 1913.

M. Emile Grabner, director of the Royal Hungarian Institute for selection of Plants at Magyaróvár laid stress, in the report which he presented to the committee of the above Institute, upon the urgent necessity of a regulation dealing with the systematic development of the selection of agricultural plants. Although in Hungary plant selection has been practised for a number of years, it is only during the last seven years that it has been successful. As the first step to promoting systematic plant selection is the encouragement of the agriculturists engaged in the task, M. Grabner suggests for this purpose the establishment of an official register of the plants selected in Hungary; the chief heads of the project are as follows:

1) The objects of the register are on the one hand to protect the rights of Hungarian agriculturists engaged in selection and to prohibit the sale of varieties which have been improved by them, and on the other to afford every guarantee to the purchaser of the strict selection of the variety which has produced the seeds he wishes to buy. This guarantee does not extend to the quality of the seeds (*e. g.* to their power of germination), nor to the value of the crop, but exclusively to the identity and purity of the variety.

2) The register will comprise field crops (cereals, root crops, oil crops, industrial crops and forage crops) systematically selected in Hungary. In the case of autogamous plants, only those can be inscribed which have been obtained from pedigree selection, or by the hybridization of pedigree varieties; in that of allogamous plants, only those are admissible which have been obtained in the same way, or by selecting families; but if the latter method is employed, it is necessary to prove that the parent plants were selected according to the revision and annual classification of the register. It is necessary, in the case of new varieties obtained from others already

the register, to prove by authentic trials that they are improved in some essential point; otherwise such varieties cannot be admitted.

3). The official register of selected plants is kept at the Royal Hungarian Institute of Plant Selection at Magyaróvár. The following details must be entered: *a*) a minute description of all the green and ripe parts of the variety registered; *b*) its date of ripening; *c*) the relative yield of the variety and of its parent plant; *d*) the system by which the improved variety has been obtained. This document must be accompanied by 50 plants of the variety to be registered, or by 22 lbs. of roots.

4). When all these conditions have been observed, the Institute undertakes the further revision, and sends an official to the spot before the time of the harvest; it is his duty to examine the condition of the seed, the selection plots and the method of selection. This official draws up a report on his observations, which he submits to the Institute; the grower must furnish all the necessary data; but should he wish to keep his method secret for further experiment, the official is required to treat the matter as a professional secret. A registration fee of 100 crowns (4 guineas) is paid to the Institute for each variety and should the grower wish to register several selected varieties, the fee for each additional one is 25 crowns (1 guinea). If it is found, on inspecting the variety on the spot, that it cannot be registered, the amount of the registration fee cannot be refunded, instead, the agriculturist has a right to another inspection within the year. The money obtained by the registration tax is deposited in the State Treasury. The Institute makes annual test sowings of the registered varieties on an area of 60 sq. yds. in the case of autogamous plants, and 240 sq. yds. for gamous ones. The owners are required to provide the seed free. The essential characters obtained by these experiments must be compared every year with those exhibited by samples grown the preceding year and preserved in the Institute collection; if any difference is observed, or if the characters are not identical with those entered in the register, the grower in question must be informed, and it must be ascertained whether the variety he has put on the market is identical with that on the register; if the contrary be the case, the variety must be struck off the register. The continued selection of a variety entered on the register is controlled by the Institute, an official being sent once a year to the estate where the selection is being carried out to examine the plant and the method employed.

The Committee unanimously approved M. Grabner's project and will submit it for the approval of the Ministry of Agriculture.

- **Agriculture in Rumania.** — CARDAS, *AGRICOLA* in *La Vie agricole et rurale*, Year 2, No. 21, pp. 604-607. Paris, April 26, 1913.

The total area of Rumania is 32 445 600 acres; of these 5 699 215 are covered by forests, while 18 045 428 are devoted to agricultural purposes and divided between the various crops as follows:

864 DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

| | | |
|--|-----------|------------------|
| Cereals | | 12 801 157 acres |
| Wheat | 5 111 695 | acres |
| Rye | 264 904 | " |
| Barley | 1 234 771 | " |
| Oats | 943 051 | " |
| Maize | 5 135 902 | " |
| Millet | 109 364 | " |
| Buckwheat | 1 470 | " |
| Textile and oil-producing plants | | 267 073 " |
| Leguminosae and potatoes | | 178 967 " |
| Industrial plants | | 60 841 " |
| Market gardens | | 58 220 " |
| Meadows (natural and laid down) | | 1 366 885 " |
| Vineyards | | 215 772 " |
| Plum orchards | | 183 292 " |
| Pastures | | 2 913 221 " |

Arable land has so far steadily increased at the expense of the past. Nearly 85 per cent. of the whole arable land is under cereals (wheat per cent. and maize 33.94 per cent.).

Large estates occupy 9 411 986 acres, which are divided between 5385 properties, some of these consisting of more than 12 000 acres. There are 38 723 medium sized holdings of 25 to 250 acres; these occupy an area of 2 131 200 acres. Small holdings account for 7 789 872 acres, divided between 920 939 owners.

The average wheat crop is 16.6 bushels (of 60 lbs.) per acre, and maize produces 14.5 bushels (of 56 lbs.) per acre.

The total value of the agricultural products of Rumania for 1908 reckoned at £55 450 000, of which the cereals alone brought in £46 038 000.

The native vines have been almost entirely destroyed by phylloxera, but the vineyards have been replanted with foreign varieties, imported especially from Algeria.

According to the census of 1908, Rumania possesses domestic animals worth £22 186 500. The horses belong to eastern breeds; in 1908 there were 807 704, representing a value of £4 323 900.

The cattle chiefly present the characters of the steppe breeds. There is a mountain and a plain variety, each of which furnishes excellent draught animals, but they are poor for beef and milk. The 1908 census showed 2 585 205 head, estimated at £13 014 000.

Sheep are principally represented by the native Tzurcana breed, long rather wavy wool, and the improved Tzigea breed, related to the Merino. According to the census of 1908 there were 5 104 506 head, worth £2 152 000.

Pigs also comprise a primitive native breed and an improved breed, the Mangalicza. Pig breeding is an important industry; in 1908 there were 1 123 564 of these animals and their value was estimated at £2 371 670.

Farming methods are rather primitive in many districts; regular irrigation is only followed on large estates, while the use of chemical fertilizers is very restricted. Cattle breeding also leaves much to be desired, though there is a pronounced activity in this direction.

Agricultural instruction is the subject of special attention on the part of the Government; it is imparted in 20 farms schools, 19 practical schools, some intermediate schools and one special school at Bucharest. The higher branches of agriculture are now taught at the Universities.

The Agricultural Credit Institutions are very prosperous. The Rural Credit possessed in 1909 credit letters to the amount of £15 293 300. There is, in addition, an Agricultural Bank, an Agricultural Credit, a Vine-growers' Credit, a Rural Bank and some Popular Banks.

Agriculture in Bulgaria. — GANTCHEFF, G. in *La Vie agricole et rurale*, Year 2, No. 21, pp. 596-603. Paris, April 26, 1912.

The value of the agricultural products exported by Bulgaria in 1911 represented 88 per cent. of that of the total exports, whilst the imported agricultural products formed only 4.4 per cent. of the total. The country has a total area of 23 798 300 acres, of which 7 988 300 were arable land, 11 500 natural meadow, 22 725 fruit and mulberry plantations, 19 500 rose gardens, 234 650 vineyards and 2 255 700 acres pastures, while forests occupied 6 995 100 acres.

The area of the arable land is constantly increasing at the expense of pastures and sometimes of the forests and meadows. Of this total area of 18 393 200 acres in 1908, 11 426 700 acres were private properties divided as follows :

| Holdings of | less than 2 ½ acres . . . | about 100 000 |
|-------------|---------------------------|---------------------|
| " " | 2 ½ to 12 ½ | " 241 399 |
| " " | 12 ½ to 25 | " 162 271 |
| " " | 25 to 50 | " 94 331 |
| " " | 50 to 70 | " 17 305 |
| " " | 70 to 250 | " 9 175 |
| " " | 250 to 1 250 | " 845 |
| " " | over 1 250 | " 91 |

Large properties are not only rare, but the area which they occupy only 2 per cent. of arable land. Division into small holdings is carried to an extreme length and constitutes a serious hindrance to the proper cultivation of the land.

In 1908 there were 5 714 651 acres under cereals, 38 230 under industrial crops, 179 703 under pulse, etc., 67 505 under melons and water-melons, 710 under vegetables, and 234 727 under forage crops, while 1 577 000 acres were out of cultivation ("resting") and 153 900 acres were under worked fallow. Thus cereal cultivation occupied about 71.5 per cent. of the cultivated area; this extraordinarily large proportion is explained by the fact that in Bulgaria maize is grown as a fallow crop and is considered a good preparation for wheat. Nevertheless, the farmers are gradually coming to realize that this system would eventually lead to the complete exhaustion of the soil, and forage crops, especially vetches and lucerne, are steadily increasing in area. Amongst cereals, wheat occupies the first place; in 1908 there were 2 688 500 acres under wheat; then follow maize with

1 560 950 acres, barley with 620 440 acres, rye with 545 200 acres, oats with 446 590 acres. Millet, spelt, rice and buckwheat are little cultivated and only in a few districts.

In 1911, tobacco occupied 29 945 acres and produced an average 630 lbs. of dried leaves per acre. Only a small amount of the crop is exported and that to Germany and Austria-Hungary; in 1910, the value of export amounted to £81 000.

During the last five years, the area under rose gardens has been at 18 500 acres. In 1911 Bulgaria exported 9 772 lbs. of attar of roses, worth £237 954.

The same year, there were only 7330 acres under sugar beets, for there is at present only one sugar refinery; but two others are in course of construction, so that the cultivation of sugar beets will develop in the near future.

The use of improved agricultural machines and implements has increased much and with considerable rapidity during the last few years. The following shows the numbers in 1893 and 1905:

| | 1893 | 1905 |
|------------------------------|--------|--------|
| Ploughs | 18 710 | 69 577 |
| Drills | 35 | 297 |
| Reapers | 128 | 1 286 |
| Thrashing machines | 17 | 250 |

Cattle breeding is as yet little developed in Bulgaria, not only from point of view of the number, but also of the quality of the animals. Efforts made by the State for the improvement of domestic animals have met with much success; in the opinion of the writer this is chiefly due to the want of markets and outlets for trade. The country, in truth, possesses all the natural conditions for intensive stock breeding, as is proved by the brilliant success obtained with some breeds in the State farms. The most important and best-adapted breeds of cattle are the Montafon and Oberinntal; in two agricultural schools Simmenthal cattle are raised while the Angle breed is kept at the Sadovo Agricultural School. Thanks to the high prices of butter and cheese, milk is more profitable than was formerly. Cow and buffalo milk is either used in its natural condition or as "kicélo-mléko" (yoghurt); very little butter is exported. Ewes' milk is chiefly used for making white cheese and "cacio-cavallo". In 1910 Bulgaria exported 2 393 100 lbs. of the former, worth £35 482 and 5 140 lbs. of "cacio-cavallo", worth £123 781.

For the purpose of improving horse breeding, the State has established three stud stations and two stallion depôts, with a total of 400 stallions, which travel throughout the country during the service period. Subsidies and premiums are also fairly frequent. For some years, the State has been buying good stud animals (bulls, cows, stallions and mares), which it lets to private individuals on condition that they keep the animals for three years under State control, and use them for breeding purposes. (In the case of cows, the State is entitled to one calf of a year old after the

ns). This system has so far not given good results, owing to lack of per control.

On account of the ready sale of eggs, the stock of poultry has greatly increased of late years; while the eggs exported in 1891 were estimated only £12 000, the figure for 1911 reached £541 000.

In 1887 there were 201 800 acres of vineyards in Bulgaria; but owing to the ravages of phylloxera the area was reduced to 147 480 acres of native vines and 20 170 acres of American varieties. In the last three or four years grafting with American vines has been carried out on a large scale.

The economic and natural conditions of Bulgaria are in general not favourable for fruit growing, though an exception must be made in the case of some little valleys where the climate is very suitable; one of these is Stendil, where fruit trees supply one of the principal sources of revenue. There are some 21 230 acres of orchards in Bulgaria, but the value of the fruit is estimated at below £14 000.

Bee-keeping has lately made great progress. There were 220 934 hives in Bulgaria in 1908, which produced over 2 million pounds of honey; this is all consumed in the country.

At one time, the idea was entertained of planting mulberry trees in the place of the vineyards which had been destroyed by phylloxera and the Government made every effort to encourage silkworm rearing. In 1891 the value of exported cocoons was only £16 890, while during the period 1906-1910 it rose to an average of £132 000 a year. But during the last two years (1911 and 1912) the great fall in the price of cocoons has destroyed the confidence of the silkworm breeders and the latter have already begun to pull down the mulberry trees.

Agriculture in French Guinea. — SOLIGNON. Les produits utiles de la Guinée française. — *Ministère des Colonies, Bulletin de l'Office Colonial*, Year 6, No. 63, pp. 65-76. Senegal, March 1913.

Hitherto only traders have availed themselves of the vegetable wealth of French Guinea, and that to a limited extent, except in the case of rice, which forms the principal staple of export. Until now the natives have only grown those crops which they required for their own consumption; they have tapped rubber trees and lianas, the produce of which is sufficient to cover the personal taxes levied on the inhabitants.

Soil. — Though but insufficiently tilled with hoes ("daba"), the soil is of extraordinary fertility. The country is mostly hilly, but it possesses some plains ("bowals") which provide pasture to numerous herds, and forests of tree-ferns and low trees, except in Lower Guinea where the lateritic, dry loamy or clayey soil lends itself to rapidly growing crops.

Climate. — There is not much difference as regards rainfall and high temperature between Upper and Lower Guinea, with the exception of the mountain group of Fouta-Djalon where the temperature is mild and not so cold. The climate of the highlands, that is of Middle and Upper Guinea, is easily supported by colonists.

Labour. — At present, owing to the emancipation of serfs, labour is abundant; further, the railways have partly suppressed the use of

porters, which system formerly absorbed most of the native labour. general both porters and farm hands are paid from 7 *d* to 9 $\frac{1}{2}$ *d* per besides about 1 $\frac{1}{2}$ lb. of rice worth about 1 $\frac{1}{2}$ *d* to 1 $\frac{3}{4}$ *d* per lb.

Agriculture. — The land may not be sold by those who occupy it because it belongs to the community of natives represented by the village or by a group of villages.

The intensive cultivation of rice, earthnuts, fonio, maize, cotton, mention only the most important crops, would give excellent results on farms organized on modern lines and provided with steam ploughs and other agricultural machines and implements.

The chief native crops are :

Rice. — Cultivated throughout the whole of Guinea in the flooded lands and in the neighbourhood of swamps and watercourses. It is the staple food of the natives, who, it is estimated, consume about 700 000 tons per year, while the production of the country is valued at only 295 000. The average price is about 10s per cwt., and the yield about £6 8s per acre.

Earthnuts. — Are grown only for home consumption, but they can be produced for exportation.

Fonio. — Is one of the crops most esteemed by the natives, who cultivate it intensively. This cereal gives, on being crushed, a very nutritious meal, which might be advantageously exported as a substitute for flour and semolina.

Maize and Manioc are not exported.

Yams are not much grown.

Kola nut tree. — Grows well in Upper Guinea near swamps and flood lands. It begins to bear fruit when about 10 years old and yields 500 to 800 nuts. The current local price is about 1 $\frac{1}{2}$ *d* per nut ; in Europe the nuts are sold at 2s 10 $\frac{1}{2}$ *d* per lb. It might be one of the principal exports of Upper Guinea ; nevertheless no Europeans have taken interest in it.

Bananas. — They are grown on a large scale by the Cameroonian Colonisation Company and they are also exported. They thrive only in Lower Guinea, though some specimens are found also in the Sahel belt. Bananas begin to bear at the age of 18 months at latest. A banana plantation yields sometimes forty times as much as an intensively cultivated potato field. Along the Konakry-Niger railway and near the coast it is one of the most remunerative crops.

Coconuts thrive well along the sea coast, reaching inland about 30 miles into the forest region. They begin to bear at eight years of age and yield an average of 33 lbs. of copra per tree per annum, worth 15s 18s per cwt. (112 lbs). The principal trading firms are those of Harland and Liverpool and especially Marseilles, which buys yearly about £32 worth of copra from Manila, Ceylon, Singapore and Mozambique colonies of the Ivory Coast and of French Congo, richly endowed with forests, would lend themselves to the exploitation of this plant better than French Guinea, where however it would be easy to grow it along the coast instead of which it seems quite abandoned in French West Africa.

Glais guineensis is abundant in French Guinea, but it is not so plentiful in the Ivory Coast and Dahomey. Replanting this tree along the rail- and near Konakry could give excellent results.

Rubber is yielded by *Funtumia elastica*, *Manihot Glaziovii*, *Hevea brasiliensis*, *Landolphia owariensis* and *L. Guineensis*. The law obliges the natives to replant the lianas. Heveas and the lianas (*Landolphia*) give the best rubber, which sells at 4s to 4s 8d per lb., while *Manihot Glaziovii* gives a fragile rubber and in smaller quantity. A new preparation is announced from Guinea: rubber in small slabs, which yields 98 per cent. of its weight of industrial rubber.

Cotton is indigenous in French Guinea; it is grown, spun and woven by the natives of Middle and Upper Guinea. A French company has attempted to extend and to improve cotton growing among the natives of French Guinea, but the results were not very successful because the varieties introduced from Egypt and America were attacked by the boll-worm (*Heliothis obsoleta*) and other parasites. It appears, however, that better results would be obtained in Middle and Upper Guinea by selecting the best varieties.

The stock. — The live stock is estimated to consist of about 2 000 000 head of cattle, 1 000 000 of sheep and 10 000 horses and asses.

The cattle of Upper Senegal-Niger are better and larger than those of the Senegal, which however yield a better flavoured beef; the writer believes that crossing the two breeds would improve them. There is no farm school in French Guinea in which animal husbandry is taught; private initiative is completely neglected.

The writer believes that European experts could realize handsome profits in the live stock trade in Middle and Upper Guinea, provided that farm schools be founded.

The Agriculture of Mozambique Province, Portuguese East Africa. — by R. N. in *Bulletin of the Imperial Institute*, Vol. XI, No. 1, pp. 102-110. London, July-March 1913.

The southern part of the Province of Mozambique, including Gazaland, is classed as sub-tropical, and is suitable for cattle grazing and the cultivation of maize. The native pastures do not fail during the dry season in the case with the high veldt, and the heavy breeds of cattle such as the Friesian and the North Devon thrive and cross well with the native cattle; however the whole district south of the Limpopo river has been cleared of bush and is infested with East Coast fever. While it is estimated that one million head of cattle are maintained on this area, it carries at present only about 5 per cent. of its carrying capacity; but the district is undoubtedly destined to become an important producing centre in the cattle and dead meat industry of the world. The greatest agricultural asset of the country is represented by the Lan- gkat rubber forests, and the question of their most profitable exploitation has been the subject of much discussion. It does not seem possible to regard them as plantations and probably the only practical and profitable method of obtaining the rubber is to cut down the vines, extract the

rubber by machinery, and utilize the land for new crops. Ceara rubber has been established in the Quilimane district, where plantations are thriving, but south of the Zambesi the climate is not sufficiently moist for its cultivation.

Mozambique possesses excellent river systems and in the river valleys ideal conditions for sugar cane planting are met with. This fact is being utilized, and the output of sugar, which was 30 000 tons in 1910, will have doubled itself by 1914. Oil-producing plants are of less importance than we should expect from the geographical position of the country: coconuts only flourish in a few coastal districts, and the seeds of *Trichilia emoda* (the source of the "mafura" tallow), which occur abundantly at Inhambane, command such a poor price on the market that it does not pay to collect them for export. Groundnuts too, though of excellent quality, will not repay the employer of labour to cultivate them.

Sisal hemp grows in all parts of the Province, and the abundant running water which is essential for the extracting factories, as well as the rather dry soil and climate in many parts, make the prospects of profitable cultivation very favourable. Cotton has been tried and proved a complete failure, but the question requires further investigation before the crop is finally condemned. The outlook for tobacco on the other hand is promising though the industry is still quite in its infancy.

On the whole, Mozambique may be said to be the country of the steam plough and of the steam plough; in only two places has close settlement been attempted. Out of the whole Province, and in fact out of the whole of East Africa, the district of Quilimane may be picked out for its remarkable fertility. It is traversed by 8 or 10 considerable rivers flowing with abundance throughout the year, and the soil, though varying in quality, is poor. The land rises gradually from the coast, the rainfall is about 60 inches per annum and well distributed, and the climate is not unhealthy as African climates go.

629 - Agriculture in German South-West Africa. — GAD, JOHANNES in *Die Landwirtschaftliche Presse*, Year XI, No. 26, pp. 316-317. Berlin, March 29, 1911.

The natural conditions prevailing in German South-West Africa compel the settlers to devote themselves to live stock breeding on extensive farms, all other branches of agricultural production falling into the background. According to the official farm list, out of the whole extent of farmed land about 26 770 000 acres, only 12022 acres or 0.045 per cent, were arable land. In the two districts most suitable for agriculture, Windhoek and Grootfontein, this percentage rises to 0.1 and 0.155 respectively.

The writer gives several reasons for the failure of the attempts hitherto made to extend agriculture: only a small proportion of the prospective settlers were farmers in their homes; the land really suitable for agriculture is limited in extent; the difficulties with which agriculture in the Colony has to contend have often been much undervalued. The small amount of rainfall, the brevity of the rainy season, the unequal distribution of the rains, the sudden frosts, the very numerous pests, form difficulties

which can only be overcome by very intensive cultivation. Where small areas are cultivated with intensive methods, crops of 900 to 1800 lbs. of maize per acre are obtained; where, however, greater areas are but shallowly tilled, frequently only 45 to 90 lbs. are harvested.

With intensive cultivation the expenses reach £2 to £4 per acre, but a crop of 900 to 1800 lbs. at about 11s per cwt. would yield a profit of £2 to £6 per acre. Even reckoning on one really good harvest, on average ones and one complete failure every four years, such intensive farming on a small scale is fairly remunerative. Wheat, oats and millet promise good and sure harvests.

A further extension of this intensive cultivation is limited by the question of its profitability. When the local consumption is provided for, the excess must be sold at the general prices of the great markets of the world, that is maize must be delivered at the port at 5s 6d per cwt. Now it seems impossible on account of the intensive tillage required, of the want of native labour and of the high railway tariffs, of the increasing northern district of the colony is to be able to compete in the south with the imports from Cape Colony and meet the wants of the country itself, it must have at its disposal sufficient cheap native labour and a lower railway tariff. The first step, however, is the prosperous development of the stock raising industry, which will give the necessary means for the establishment, in the course of time, of healthy farming in German South-West Africa.

- **The Island of Formosa.** DAUTREMER, JOSEPH in *Bulletin de la Société de Géographie Commerciale de Paris*, Vol. XXXV, No. 3, pp. 164-171. Paris, March 1913. General information about the economic importance of this island, the monopolies of opium, salt, camphor and tobacco. Also regarding the progress of the irrigation works and the rice production; the amount of rice present exported to Japan is worth over 18 million frs. (£700 000). Cultivation of sugar cane is extending, and the value of the sugar now exported to Japan is 90 million frs. (£3 500 000). Tea, however, is the largest export: green tea, «oulong», «souchong» and black are exported to the value of 17 or 18 million frs. The chief agricultural products, in addition to those already mentioned, are sweet potatoes, ramie, jute and indigo.

- **Agriculture in the "Altos" of Guatemala.** — SAPPER, KARL in *Der Tropenpflanzer*, Year 17, No. 4, pp. 191-199. Berlin, April 1913. Notes upon the conditions of agricultural exploitation in western Guatemala: Climatic conditions, cultural methods and the chief crops (maize, wheat, lucerne, potatoes) are dealt with.

- **Courses of Instruction and Lectures on Fruit, Vegetable and Flower Culture in Belgium.** — *Ministère de l'Agriculture et des Travaux publics, Bulletin de l'Agriculture et de l'Horticulture*, Year 2, No. 6-7, pp. 361-421. Brussels, 1913. Last winter, in accordance with a Ministerial Decree of September 1912, courses of instruction consisting of 20 lectures on fruit- and vegetable growing were held in 22 places in Belgium and similar lectures on

market gardening in 10 places. Series of lectures (generally 5 or 6 number) were also given; of these the subject in 244 places was fruit growing, in 242 market gardening, and in 61 flower-growing.

The Ministerial Decree contained a detailed curriculum both for instruction courses, and for the series of lectures.

633 - **The Agricultural Curriculum at the Hamburg Colonial Institute.** - *Hamburgisches Kolonial-Institut und Allgemeines Vorlesungswesen, Verzeichniss der Vorlesungen im Sommerhalbjahr 1913*, pp. 6. Hamburg, 1913.

The course on colonial agriculture at the Hamburg Colonial Institute includes: agriculture, veterinary science, natural science, and economy; also optional attendance at all the other lectures and at foreign language classes. The course lasts four terms, and at the conclusion the students may take an examination for a diploma for proficiency in Colonial agricultural knowledge.

634 - **The Establishment of a German School of Pisciculture at Eger.** - *SCHUBERT, OTTO KAR* in *Oesterreichische Fischerei-Zeitung*, Year X, No. 7, pp. 114. Vienna, April 1, 1913.

The Provincial Agricultural Council of Bohemia proposes establish a German School of Pisciculture for the theoretical and practical instruction of pisciculturists and of the staff employed in fish-breeding establishments. The school in question will be at Eger, a town which of every facility for the sale and despatching of fish, as well as for the practical work of fish-breeding.

635 - **The Royal Practical School of Agriculture at Todì (Perugia, Italy)** *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year 12, Vol. Series A, Part 9, pp. 231-253. Rome, March 1, 1913.

The organization (administration, teaching staff, regulations) and curriculum of the course, which extends over a period of four years.

636 - **Amalgamation of the Poultry Stations in South Australia.** - *LAURIE, I.* The Poultry Stations. Scheme of Amalgamation. - *The Journal of the Department of Agriculture of South Australia*, Vol. XVI, No. 7, pp. 784-786. Adelaide, February 1

The scheme for amalgamating the three existing Poultry Stations Roseworthy, Kybybolite and Murray Bridge has been approved by Minister of Agriculture and will be given early attention. There will be one central State Poultry Station at Parafield, about 10 miles from Adelaide. Its objects will be to carry on the laying competitions and various experiments. All experiments will be on a large scale, and breeding, cubation and other experiments will be carried out. Table-bird breeds will form a special branch, and only proved breeds will be kept. A grant revenue to pay for the work will be obtained by keeping some thousands of hens and pullets to supply market eggs.

A large building will be converted, so as to provide two large incubation rooms. Two large brooder houses will be erected and yards laid out to provide accommodation for rearing chickens, breeding stock, experimental work, egg production, etc.

The new Poultry Station will afford excellent opportunities for teaching pupils the newest methods in poultry rearing and keeping.

Ruakura Farm of Instruction. A Digest of the Work of the Year. — MCCORNELL, PRIMROSE in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. 6, No. 1, pp. 24-33. Wellington, January 15, 1913.

Numerous experiments were made, or continued, the subjects dealt with being as follows: 1) plant selection (cereals, turnips and mangels) and plant diseases; 2) forage plants for dairy-cows; 3) manuring (pastures, non-manuring); 4) fat lamb breeding, calf-rearing (raw crushed linseed meal equal to boiled or scalded as cream-substitute), treatment of stomach-achies in sheep. A lucerne paddock has been successfully established on swamp land. Numerous sittings of eggs of carefully selected poultry have been distributed. The Farm has also sent authentic exhibits and information to the various shows throughout the Dominion.

Regulation for the New Higher School of Agriculture and Veterinary Medicine in Brazil. — *Diário Oficial, Estados Unidos do Brasil*, Year LII, No. 24, pp. 1473-1486. Rio de Janeiro, January 29, 1913.

The Decree No. 9857, dated November 6, 1912, approves the regulation (which is annexed to the decree) of the "Escola Superior de Agricultura e Medicina Veterinária" about to be instituted. Education in agriculture and in veterinary science will form two distinct courses for agricultural engineers and for veterinary surgeons. The special course for the former will last three years; for the latter four years. Each of them will be preceded by a preparatory course of one year.

An experimental field (Fazenda experimental) will be attached to the school. It will be devoted to the practical teaching of agriculture, animal husbandry and the chief rural industries, as well as to experimentation in extensive and intensive methods of growing the industrial and forest products of the country.

The Great Agricultural Week in Paris. — HITIER, H. in *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year 112, No. 3, pp. 462-472. Paris, March 1913.

The Great French Agricultural Week was held in Paris from the 17th to the 24th of February. In this time the following Agricultural Associations held their general assemblies: Société des Agriculteurs de France, Association des Ingénieurs-agronomes, Société des Viticulteurs de France, Comité de l'Industrie laitière, Syndicat des Fabricants de Sucre, Union nationale des Syndicats des Agriculteurs de France, Syndicat Central des Viticulteurs de France.

A general Agricultural Exhibition was held at the same time; the different sections of the latter were as follows: fat stock, dairy produce, agricultural and horticultural produce, packing materials, and agricultural machinery.

The "Société des Agriculteurs de France" which has over 10,000 members and is divided into 14 sections, held sectional meetings every evening during the week and general meetings in the afternoons; the discussions were on technical, economic, and social questions connected with agriculture, such as mechanical ploughing, the employment of electricity

in agriculture; the labour question, the housing of labourers, legislation, regulation of labourers' pensions, home work. Amongst other decisions the meeting resolved to devote 20 000 frs. (nearly £800) to make exhaustive trials with mechanical ploughs at Puiseux (Seine-et-Oise).

The "Société d'Encouragement à l'Agriculture" held a three-day Congress for the purpose of discussing questions connected with the exportation of agricultural produce, the sale and exportation of cereals, cattle, pigs and pork, wine, fruit and fruit wines, olive oil, vegetables and flowers.

The chief result of the fat stock show was the proof afforded of the fine producing qualities of the Charolais cattle and the Craonnais pigs.

After briefly mentioning the exhibition of the products of agricultural industries, and the exhibition of the agricultural and horticultural products of Algeria, Tunisia, Morocco, the Mediterranean coast and Rhone Valley organised by the P. L. M. railway, the writer gives some interesting information concerning the development in the trade in cereals, vegetables and flowers from the South of France and Algeria, and measures adopted by the above Company for the rapid despatch at low rates of this produce to the Parisian and foreign markets.

Over 160 makers of agricultural machines sent exhibits to the show. Of these the motor ploughs and milking machines aroused the most interest.

640 - Agricultural Shows.

Austria:

1912. Sept. 7-9. Kirchdorf a. d. Krems (Lower Austria). — Agricultural and Industrial Exhibition organized by the "Landwirtschaftlicher Bezirksverein in Kirchdorf."

Belgium.

1912. Sept. 7-9. Louvain. — Ornithological Exhibition. Sec.: M. Eug. Tant, 153, Rue de la Station, Louvain.

Nov. 15-17. Renaix. — International Show of the Renaix Pigeon Club. For information, address: M. O. Rose, Renaix.

Dec. 13-16. Liège. — Third International Show of Birds of all species, organized by Liège Avicultural Society ("Société ornithologique"). For information, address to the Sec.: M. Ch. de Neef, 46, rue des Mineurs, Herstal.

Denmark.

1912. Summer (opens June). Copenhagen. — General Cold-storage Exhibition, organized by the "Association des Industries." Address: Bureau of the "Association des Industries," Copenhagen.

France.

1912. July 16-19. Saumur. — Central Show organized by the "Société d'encouragement à l'élevage du cheval de guerre français" (Society for encouraging the breeding of French army horses).

Sept. 23-24. Saint-Quentin (Saint Lazare farm), Aisne. — Competition in mechanical pulling, organized by the "Comice agricole" of the arrondissement of Saint-Quentin. Address, before Aug. 15, to the general sec.: M. Cardon, rue de Gouverneur, 36, Saint-Quentin.

October. Saint-Etienne. — Show of industrial inventions and novelties. Address to the offices of the "Union des Inventeurs de la Loire," Hôtel de Ville, Saint-Etienne.

- Oct. 24-Nov. 2. *Paris*. Cours-la-Reine. — General autumn horticultural show, organized by the "Société Nationale d'Horticulture de France".
- Nov. 6-10. *Bordeaux*. — General autumn show, organized by the "Société d'Horticulture de la Gironde." Address, before Oct. 20, to the general sec.: M. Morain, 10 rue Sainte-Catherine, *Bordeaux*.
- Nov. 19-23. *Moulins*. — Poultry Show, organized by the "Société des Aviculteurs et Agriculteurs du Bourbonnais et du Centre." Address to the president: M. Buvat, 8, avenue Victor-Hugo, *Moulins*, Allier.
- May 1-Nov. 1. *Lyons*. — International Urban Exhibition. Sections will be reserved for foods of animal origin in general, and for milk and its derivatives.
- Germany*.
- July 11-13. *Corbach*. — Agricultural Show for Waldeck and Pyrmont. Address to "Geschäftsstelle der Landwirtschaftskammer," Mengeringhausen.
- Holland*.
- June 26-July 10. *Sittard*. — International Exhibition of Industry, Commerce, Agriculture, Arts and Science.
- Aug. 20-22. *Kampen*, Zandberg, Champ de Mars. — Agricultural Show, and annual meeting of the Agricultural Society of Guelders and Overijssel.
- Italy*.
- September. *San Vito al Tagliamento* (Udine Prov.). — Cooperative Dairy Show, organized by the "Circolo agrario" and the "Cattedra ambulante di agricoltura" of San Vito al Tagliamento.
- Milan*. — Exhibition of Cold, Heat and Light, on the occasion of the 50th. anniversary of the founding of the Milan Polytechnic School.
- Melegnano* (*Milan* Prov.). — Lombardy Agricultural Show.
- Japan*.
- October. *Yokohama*. — Japanese Agricultural and Industrial Exhibition, organized by the "Kwangyo Kyotai" (Industrial Association) of Yokohama. A section is devoted to products imported into Japan.
- Autumn. *Toyama* and *Kagoshima*. — Provincial shows.
- Tokyo*, Ueno Park. — Exhibition organized by the Prefecture of Tokyo (under Government patronage). Foreign products will be admitted.
- Norway*.
- Christiania. — Norwegian Jubilee Exhibition ("Norges Jubileums-Utstilling"). Will include a permanent and temporary agricultural shows.
- Panama*.
- Jan. 21-May 31. *Panama City*. — National Exhibition on the occasion of the fourth centenary of the discovery of the Southern Pacific by Adelantado Vasco Núñez de Balboa.
- Peru*.
- Nov. 2-Dec. 31. *Lima*. — International Exhibition of Hygiene. A section is devoted to food materials and non-alcoholic drinks. Entries close Oct. 20. Address to: "Presidente de la Comisión Ejecutiva de la Exposición de Higiene", Academia de Medicina de Lima, Plaza de la Exposición, Lima, Peru.
- Portuguese East Africa*.
- October. *Loanda*. — Agricultural Show.
- Russia*.
- Sept. 5-8 (Aug. 23-26 old style). *Mitau*. — Agricultural Show organized by the "Kur-ländische Ökonomische Gesellschaft" of Mitau.
- Spain*.
- May (provisional date). *Valencia*. — Exhibition of agricultural machines, and especially machines for rice-growing and rice driers, on the occasion of the International Rice-Growers' Congress.

Switzerland.

1914. May 15-Oct. 15. Berne. — Swiss National Exhibition.

Tripoli.

1913. Autumn. Tripoli. — First Italian Industrial Exhibition. Includes a section for culture, colonisation and local industries. Offices: Via Maddalena, 15, Milan.

United Kingdom.

1913. Islington (London), Agricultural Hall. — Second International Exhibition of the Industry, Engineering and Metallurgy. Organiser: F. W. Bridges, 124 Holborn, London, E. C.

Uruguay.

1913. Autumn. Montevideo, Prado. — General Agricultural Show, organized by the "Asociación rural del Uruguay."

641 — *Congresses.**Austria-Hungary.*

1913. June. Kaschau — Congress of Hungarian Farmers, organized by the Hungarian Farmers' Society.

Belgium.

1913. Aug. 1-5. Brussels. — Third International Congress for the Study of Cancer, organized by the Belgian Commission for the Study of Cancer. Address to: Dr. Hugué, Palais du Cinquantenaire, Brussels.
Sept. (early). Ghent. — Pomological Congress.

United Kingdom.

1914. Aug. 3-8. London. — Tenth International Veterinary Congress. Address of Organising Committee for Great Britain and Ireland: Royal College of Veterinary Surgeons, Red Lion Square, London, W. C.

CROPS AND CULTIVATION.

642 — *Weather Forecasting and Sun Spots.* — POSKIN, P. *Météorologie et Agriculture* (Inaugural address for the Session 1912-1913 delivered at the Agricultural Institute). — *Annales de Gembloux*, Year 23, Nos. 1 and 2, pp. 1-61 and 61-89. Brussels, February and March, 1913.

After a brief account of the present state of meteorological science and a short history of the development of the meteorological service in the different countries, the difficulties of accurate forecasts in Europe are dealt with, and shown to be due in part to the irregular course taken by the cyclonic disturbances, and in part to the lack of recording stations on the eastern side of the Atlantic Ocean. Long period forecasts of the average weather to be expected in the more or less distant future, are then discussed, the question being whether there exists any periodicity in meteorological phenomena, and if so what its fundamental character may be.

While meteorologists are agreed on the fact that the primary cause of meteorological disturbances lies in the unequal distribution of heat over the earth's surface, opinions differ as to the latter's connection with solar phenomena. Sun spots have been observed since the time of Galileo and an examination of their records shows that their area — which is correlated with general solar activity — increases and decreases periodically.

ally, the interval between two maximum or minimum points varying from 8 to 14 years, with an average of 11.2 years. Besides this, there is exhibited a further periodicity of 33.6 years, that is to say that in every third period the maximum point is higher than the maximum points in the two intervening periods.

Nordmann, working with data from the tropics where the climate is more regular, plotted the variations of the annual mean temperature above and below the mean for the whole period (1870-1902). He then compared the curve thus obtained with the inverse curve of the frequency of the sun spots for the same period, and showed that there was a remarkable agreement between the two curves. In temperate regions with an irregular climate, this correlation is far less apparent but still exists. The meteorologist, using data from Uccle, Belgium, for the period 1833-1912, plotted the differences between the monthly mean temperature for each month and the average temperature of the month over the whole period. The resulting curve is very irregular; usually one or two months above the average followed by one or two months below the average; but from time to time, at intervals of 11 years, several hot months follow one another, and the periods of higher temperature correspond to periods of least solar activity. Data from Paris confirm the results in a general way, as do other data from S. Francisco, Sacramento, and San Diego.

Professor Douglass, working with old pine trees in Arizona, measured the radial thickness of the annual rings, and plotted the results. He related that there were specially high and specially low points in this every 32.8 years, with less marked points every 11 years (1). The periodicity of seasons of high rainfall has been shown for Ceylon by Lockyer; for Mauritius, Port Louis, Brisbane, and Adelaide by Mellor; for Central Europe by Brückner, and in each case the periods are approximately 11 or 33 years and correspond to periods of high solar activity. The rainfall data at Uccle were treated in the same way as the temperature data alluded to above; but they did not exhibit the regular periodicity of tropical rainfall.

A careful study of the curve, however, showed that periods of low solar activity and high temperature are also somewhat drier.

The records of the water level of the Swiss lakes have also been studied. Abnormally high levels with intermediate abnormally low levels have been recorded every 30 to 40 years from 1700 onwards.

Finally a close connection has been traced between an increase in the number of sun spots, and increased magnetic disturbances on the earth. To summarise: though the correlation between solar phenomena and terrestrial meteorological phenomena has not yet been completely worked out, it is a remarkable coincidence that a minimum solar activity should always be accompanied by a rise in temperature, a lowering of the rainfall and a reduction of electric and magnetic disturbances.

¹⁾ See also No. 224, B. March 1913.

- 643 - **Meteorological Conditions in a Field Crop, with a Description of Simple Recorders.** — BALLS, W. L. in *Quarterly Journal of the Royal Meteorological Society*, Vol. XXXIX, No. 166, pp. 109-113. London, April 1913.

The experiments were carried out in a cotton field in Egypt; showed that the cotton plants lower the temperature and raise humidity of the surrounding air to a considerable extent, even at night when transpiration is reduced. A gentle breeze immediately raised temperature and lowered the humidity, and the particular interest of phenomenon to the plant physiologist lies in the rise of tissue temperature and the consequent increased growth-rate of the plant which thus produced.

Two of the instruments used in taking the observations were of author's own devising: one of them was used for measuring low wind velocities and the other for recording clouds at night.

- 644 - **Classification of the Soils in Glaciated Regions according to Size of Particles and Physical Properties.** — FROSTERUS, BENJ. in *La Pédologie*, Year No. 4, pp. 52-60. St. Petersburg, 1912.

After a short introduction explaining the use of the terms "Ablation" (earthy deposit) and "Boden" (soil), the writer, by means of tables giving the results of his soil investigations, shows that the mineral earthy deposits in glaciated regions are to be classified according to the size of their particles and their physical properties. In conclusion, he gives the type divisions of soil which should be indicated in field-maps in Finland.

- 645 - **Osmosis in Soils, and Possible Applications of the Principle.** — 1. LYNDEN, C. J. Osmosis in Soils. Soils act as Semi-permeable Membranes. — *Journal of Physical Chemistry*, Vol. 16, No. 9, pp. 759-765 + 3 figs. December, 1912.

2. LYNDEN, C. J. and BATES, F. W. — *Ibid.*, pp. 766-781 + 2 figs.

In the first article, the writer shows by means of experiments that a clay subsoil acts from the osmotic point of view as a semi-permeable membrane (i. e. allows free passage to the molecules of water, but not to those of dissolved substances in a given solution) and that water is moved through the soil by osmotic pressure.

The experiments described in the second article were made with different subsoils and with others containing a high percentage of sand and a percentage of clay.

They showed that for sterilized clay subsoil in the presence of water: 1) the soil acts as a semi-permeable membrane; 2) the efficiency of a column of soil as a semi-permeable membrane increases with its depth; 3) water moves through the soil towards a solution and develops a certain osmotic pressure; 4) the osmotic pressure developed increases with temperature.

This theory is only substantiated by the experiments in the case of heavy clay subsoil prepared by settling out of suspension in hot water in a centrifuge. No osmotic pressure was developed when a sandy soil was used.*

The theory is suggestive for agricultural practice in the following ways :
Tillage. — The different operations of tillage promote the growth of bacteria, which increase the concentration of the soil solutions in the upper layers of soil. This in turn increases the osmotic pressure of these solutions, and therefore increases the amount of water raised from the lower layers through the subsoil.

Drainage. — It is well known that crops on drained land receive more moisture than those on undrained land. This may be due to deeper root action, but it may also be attributable to the fact that, in drained land, the water level is lowered to a depth of 3 or 4 feet below the surface. This permits water to enter to this depth, which promotes the growth of bacteria; the latter produce more soluble salts and these increase the concentration of the soil solutions and thereby the osmotic pressure, so that a larger amount of water is lifted from below through the subsoil.

Manure. — Experiments made by King show that in land treated with manure well worked in, the rise of water is stronger than in land not so treated. This cannot be due to a greater capillary rise, but appears to be attributable to the increased number of bacteria, which produce a larger amount of soluble salts; this increases the osmotic pressure of the soil solutions near the surface and therefore the amount of moisture raised through the subsoil.

Mineral fertilizers. — When mineral fertilizers are added to the land, the concentration of the soil solutions near the surface is increased; this raises the osmotic pressure of these solutions, and, according to the writers' theory, should increase the amount of moisture raised through the subsoil.

Increase of temperature. — The rise of water in the soil, in so far as it is due to osmotic pressure, is increased by a rise in temperature in various cases.

The soil mulch. — Under a soil mulch the land is moist and warm and the conditions are ideal for bacterial growth. Thus the osmotic pressure of the soil solutions is increased and more water is raised through the subsoil.

Dry farming. — In dry farming it is the practice in some cases to plant crops every other year, and to maintain a mulch on the land in the off years.

The writers' theory suggests that the increased crop the second year is partly due to the increase in the osmotic pressure of the soil solutions near the surface owing to bacterial action, as explained under "soil mulch" above.

This theory opens up a large field for investigation in soils; Amongst the questions for solution are the following:

- 1) Do soils other than clay subsoil act as semi-permeable membranes?
- 2) Does the efficiency of a soil as a semi-permeable membrane depend on the percentage of clay it contains? If so, how?
- 3) Do soils under field conditions act as semi-permeable membranes?
- 4) Do the operations of tillage increase the amount of water raised through the subsoil?

5) Are there substances, other than those at present known, are not plant foods, but which can be used as fertilizers with benefit from the point of view of their action on the osmotic pressure of the soil?

646 - The Partial Sterilization of Soil and the Nature of the Limiting Factor of Bacterial Development. — RUSSELL, E. J. and HUTCHINSON, H. B. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. V, Pp. 152-221 + 7 figs. Cambridge, March 1913.

The writers have by these further experiments confirmed and extended the results reached in their previous paper (1). Fresh evidence is added that bacteria are not the only inhabitants of the soil, but that another type of organisms occurs, detrimental to bacteria, multiplying more slowly under soil conditions and possessing lower power of resistance to heat and antiseptics.

In consequence of the presence of these detrimental organisms, the number of bacteria present in the soil at any time is not a simple function of the temperature, moisture content and other conditions of the soil may indeed, show no sort of connection with them; thus rise of temperature and increase of moisture content are found to be ineffective in increasing the bacteria in the soil. The number of the latter depends on the degree of activity of the bacteria and the detrimental organism.

Partial sterilization leaves the former unharmed, but kills the latter. As do antiseptic vapours or the heating the soil to 55 or 60° C. Whenever treatment is sufficiently energetic to kill the bacteria, these micro-organisms rapidly increase as soon as the soil conditions are made normal. Once detrimental organisms are killed, however, the only way of introducing them again is to add some of the untreated soil, but the precise conditions governing the transmission are unknown.

The writers provisionally identify the detrimental organisms of the soil with the active protozoa of the latter, but as the zoological survey is yet incomplete, they do not commit themselves to any definition of the protozoa, nor to any particular organism, or set of organisms.

As there is a great diversity of opinion on this point (2) it may be better to mention some of the experiments made by the writers, who in all sterilization operations, always sought for and obtained protozoa. The soil is inoculated into a one per cent. hay infusion and left in an incubator at 25° C for 4-5 days, examination being made periodically for protozoa; they are roughly grouped as ciliates, amoebae, and monads. Partial sterilization simplifies the fauna considerably, killing the ciliates and amoebae but leaving certain monads. Whenever the ciliates and amoebae were killed, the investigators invariably found that the detrimental factor was extinguished; whenever the detrimental factor was not extinguished, the protozoa also were not killed.

The following are typical results for heated soils:

(1) See No. 14, B. Jan. 1913.

(2) See No. 467, B. May 1913.

| | Bacteria after 68 days. Millions per gram of dry soil | Ammonia and nitrate formed after 68 days. Parts per million of soil | Detrimental factor | Protozoa found |
|----------------------|--|--|-----------------------|-------------------------------|
| ed soil | 11.1 | 13 | present . . | ciliates amoebae monads |
| to 40° for 3 hours . | 7.5 | 14.4 | present . . | ciliates amoebae monads |
| to 56° for 3 hours . | 37.5 | 36.7 | killed . . . | all killed |

treatment with toluene leads to similar results:

| | Bacteria after 30 days. Millions per gram | Ammonia and nitrate formed after 30 days | Detrimental factor | Protozoa found |
|------------------|--|---|-----------------------|---------------------------------------|
| d Soil | 8 | 24.5 | present . . | ciliates amoebae monads |
| l soil | 47.4 | 41.6 | killed . . . | all killed but certain mo- nads |

icklime also produces the same effect. .
the writers' methods of dealing with soil protozoa do not reproduce
ons in the soil, they abstain at this stage from laying too much stress
relationship that comes out, but which may only be accidental,
their detrimental organisms and any of the ciliates, amoebae and
that their methods reveal. But it seems safe to draw two conclusions:
detrimental organisms possess the properties of protozoa and not of
1; 2) the presence or absence of the detrimental organisms is inti-
associated with the presence or absence of a complex protozoan fauna.

The increase in bacterial numbers following after partial sterilization by volatile antiseptics is accompanied by an increase in the rate of ammonia production until a certain amount of ammonia and nitrate has accumulated when the rate falls. Thus two cases arise: 1) when only small amounts of ammonia and nitrate are present, there is a relationship between bacterial numbers and the rate of ammonia production; 2) when large amounts of ammonia, or of ammonia and nitrate, are present there is no relationship. The limit varies with the composition and condition of the soil.

Complications are introduced when the soil has been partially sterilized by heat, as the organic matter is decomposed and some of the bacterial activities are exterminated. These effects become more and more pronounced as the temperature increases; the maximum number of bacteria are found in soils which have been heated to 60°C, while this is the minimum temperature necessary to kill the detrimental organisms.

At this temperature, we have the same relation between the two organisms as obtains when the soil is treated with volatile antiseptics. Although bacterial numbers are at a minimum in soils heated to 60°C, the decomposition effected is at a maximum. With this exception, generally true that bacterial multiplication may go on without increase in the production of ammonia, but an increase in the rate of production of ammonia does not take place without bacterial multiplication.

The increase in bacterial numbers brought about by addition of bacteria from the untreated soil into partially sterilized soil leads to still further production of ammonia and nitrate, unless too large a quantity of these substances is already present. But the subsequent depression in bacterial numbers consequent on the development of the detrimental organisms generally (though not always) without effect on the rate of decomposition apparently because it does not set in until too late.

647 — *Irrigation on the Southern Side of the Pyrenees.* — DE CONTENSON in *Économique Internationale*, Vol. I, No. 1, pp. 76-95. Brussels, January 15-20, 1902.

There are large tracts of fertile soil in Northern Spain which are rendered unproductive by lack of water, and with the mountain range at hand and a proper utilization of its water resources, much might be done in the way of reclamation.

The Royal Irrigation Company of the Ebro Agricultural Syndicate has been established 19 years, and during that period the receipts for irrigation water have risen from £2106 in 1892 to £11713 in 1911, forming 93 per cent of the total receipts at the latter date. The success of this company induced Sr. Romana to formulate a project for an irrigation system of water canalization which is to reclaim 300 000 hectares (740 000 acres) in Upper Aragon at a cost of 535 pesetas per hectare (£8 11 s. 11 d. per acre).

The region covered consists of gentle slopes and wide plains with a gradual fall of about 1180 feet. At present it is estimated that 100 000 hectares (nearly 10 000 acres) receives some irrigation of an irregular and

the kind, 196 000 hectares (484 300 acres) are unirrigated but produce crops of cereals or are planted to a small extent with vines or olives, and 100 000 hectares (247 000 acres) are altogether uncultivated. Production is uncertain, and in periods of drought the population either emigrate or starve. The value of the ground in this area may be estimated as follows :

| | Millions of pesetas | |
|--|------------------------|---------------|
| 196 000 hectares with irrigation at 1 500 pes. per ha. (£ 24 p. acre) | 4 | (£ 160 000) |
| 100 000 hectares not irrigated, but cultivated, at 450 pes. per ha. (£ 7 4s p. acre) | 88 | (£ 3 520 000) |
| 100 000 hectares uncultivated at 100 pes. per ha. (£ 1 12s p. acre) | 10 | (£ 400 000) |
| Total | 102 | (£ 4 080 000) |

With a reliable water supply its value would be :

| | Millions of pesetas | |
|--|------------------------|----------------|
| 196 000 hectares suitable for cereals at 500 pesetas per ha. | 345 | (£ 13 800 000) |
| 100 000 " " for intensive cultivation at 3 000 pes. per ha. (£ 48 p. acre) | 210 | (£ 8 400 000) |
| Total | 555 | (£ 22 200 000) |

Even when the cost of the undertaking is deducted, a profit of over 100 pes. per ha. (£6 3s per acre) is obtained ; further it is estimated that the annual gross returns will increase from 69 to 349 pes. per ha. (17s to £4 12s per acre). The annual rainfall varies from 20 inches, but as it is regular and evenly distributed an allowance of 10 inches of irrigation water would be sufficient to secure the cereal crops. A description is given of a very successful piece of reclamation carried out on a small scale by a landlord in the zone of the Aragon-Cataluña. The water has been brought 5 ½ miles from the main canal, in order to provide the necessary labour for the scheme, a small colony or model village has been established. The landlord bears the expense of settling in the tenant or colonist, and of stocking the land, and receives in return one half of the yields of corn and forage crop. The colonists, in addition to cultivating their holdings, undertake to reclaim a certain additional amount of fresh land every year. Contracts are entered into for six years, but any time previous to expiration the tenant may pay back the expenses incurred on his land, and in that case a fresh arrangement is made, by which the tenant receives four-fifths instead of one half of his harvests. Though the system has only been working for three years, already half the loans have been repaid.

With regard to method of cropping, as well as in all other questions of management, the landlord reserves the right of imposing his

rules on the tenant. The reclamation of land is encouraged by paying a fair price (40 s per acre) for all work done by the tenant over and above his contract and, further, the landlord himself reclaims 18 to 20 (44 to 49 acres) every year. In this way 200 hect. (494 acres) of barren land have been brought under cultivation at a cost varying from £5 per acre where the landlord himself bears the cost of the labour to £4 per acre where the colonists supply the labour; profitable employment has been provided for several families, numbering in all 24 individuals; and the success of the experiment has induced other landlords to introduce similar systems on their estates, so that as the possible irrigable zone of the canal is 100 000 hect. (247 000 acres) it seems safe to predict that the population of the district will shortly increase to five times present numbers and will more than justify the expenses incurred by Government in the construction of the canal.

648 — **The Experimental Drainage Field at Josephsdorf, Germany.** — KRÜGER in *Mitteilungen des Kaiser Wilhelm Instituts für Landwirtschaft*, Vol. V, Part 1, pp. 173-185. Berlin, February 1913.

As is well-known, the beneficial effect of drainage is not only due to the removal of the superfluous water, but also to the subsequent aeration of the soil. Mierau in 1890, followed first by Klinkert, and recently Friedersdorff, Holdefleiss and Heinze, showed the importance of studying aeration on experimental fields; but unfortunately no observations have been made on the effect of such aeration.

Other points in draining which are of no less consequence are the depth and distance apart of the drains. It is surprising that the solution of a question of such great economic importance has been so long deferred. Kopecky was the first to show that the distance between drains must be determined as a function of the mechanical composition of the soil and of the amount of water to be removed. He advocated therefore the mechanical analysis of the soil as a basis of drainage operation. His suggestion was followed and further developed by Fauser and C. Recently Breitenbach has tried to deduce from the hygroscopicity of the soil the right distances at which to place the drains (1).

Since the introduction of drainage the question of the most suitable depth for drains in heavy clays has been the subject of the keenest discussion.

There is no doubt that the solution of all these questions is of paramount practical importance. The Minister of Agriculture for Prussia, being convinced of this fact, transmitted, in 1908, Mierau's proposition to the Society of Agricultural Improvements, and entrusted the latter with the task of laying out an experimental field for the purpose of solving all these problems.

After a prolonged search, a field suitable for the purpose was found at Josephsdorf in the district of Culm, which its owner, Hr. Plehn, consented to lend for a period of 10 years. According to the project, the following points are to be studied:

(1) See No. 1271. B. Sept. 1912.

- 2) Drainage with drains situated at different distances apart : 52, 26 ft.
 - 3) Drainage at different depths : 5 ft., 4 ft. and 3 ft.
 - 4) Drainage with and without aeration.
- There are thus 18 variants.

The aim of the drainage experiments is the solution of the following questions : the influence of the variants on a) the production; b) the proper air circulating in the soil; c) the amount of water removed; d) the way with which the rain water reaches the drains; e) the development of the roots; f) the mechanical modifications of the structure of the soil. These are the bases on which the project was elaborated, and the work was begun in March 1911. The field has an area of $8\frac{3}{4}$ acres; the cost of the drainage amounted to £ 97.

The drainage works have only been one year in operation, it is nearly impossible as yet to give any experimental results.

Best Cross-Section for Ditches in Drainage Operations. — SCHÖNFELDT, A. *Der Kulturtechniker*, Year XVI, No. 2, pp. 130-134. Breslau, April 1, 1913.

Making intakes for water; and supply and drainage channels, which are the most costly items in irrigation and drainage work, it is necessary not only to take into consideration the quality of the work, but also the question of the financial and commercial basis of the latter. The question can only be solved in a satisfactory manner, when the increased cost due to the work not only defrays the depreciation and upkeep, but also permits of the formation of a reserve fund, i. e. when the cost of the capital expended is at least 5 per cent.

In the choice of section it is necessary, apart from theoretical considerations, to have some idea of the relation between the cost and the section, and to choose the smallest form of section which (with the existing means) ensures the amount of water required. The formulae of Ganguillet and Kutter are generally employed in making these calculations. From the calculations mentioned by the writer it appears that the semicircle where the water flows through the centre of the circle presents the best section. Unfortunately this form of section cannot be used and it is necessary to change the semicircle into a trapezoid in order to reconcile theory and practice.

The Effect of Loosening the Subsoil on Yield. — AUGSTIN in *Illustrierte Landwirtschaftliche Zeitung*, Year 33, No. 32, pp. 303-304. Berlin, April 19, 1913.

In loosening the subsoil, as well as in the construction of subsoiling machines, two tendencies have to be sharply distinguished: one strives to loosen as much as possible of the subsoil to the same depth by means of the shallowest possible implement, and without mixing the loosened subsoil with the upper layer; the other endeavours to cut by means of a spring subsoiler the deepest possible groove about $1\frac{1}{4}$ inch wide at the bottom of the furrow, with the result that a part of the loosened subsoil falls into the groove, while the greater part in a state of fine division remains on the surface with the upper layer. In order to investigate the relative

TILLAGE AND
METHODS OF
CULTIVATION

A. Zieckau Experiment Field.

Lochow's yellow oats.

| Plot | Yield per plot of $\frac{1}{16}$ acre | | Average yield per acre | |
|---|--|--------|---------------------------|--|
| | Grain | Straw | Grain | |
| | lbs. | lbs. | lbs. | |
| I. Shallow ploughing | 770.5 | 971.3 | 2391 | |
| V. Duplicate | 706.5 | 858.8 | | |
| II. Shallow ploughing with groove sub- soiling | 723.1 | 1040.8 | 2444 | |
| VI. Duplicate | 787.0 | 998.9 | | |
| III. Shallow ploughing with subsoiling of whole width. | 703.2 | 917.3 | 2244 | |
| VII. Duplicate. | 683.4 | 804.8 | | |
| IV. Deep ploughing | 723.1 | 829.1 | 2264 | |
| VIII. Duplicate | 675.7 | 858.9 | | |

vantages of the two systems and to compare the effects of deep and ploughing, the writer conducted some cultivation experiments at Friedeberg and at Zieckau in the autumn of 1911, on two fields each 1 hectare (2.47 acres) in extent. At Friedeberg the soil of the experiment field is a sand with similar subsoil; at Zieckau, it is a slightly humous and loam with compact loamy sand as subsoil.

At Zieckau only oats were grown; at Friedeberg half of the field was sown with oats and the other half barley. The various plots, save for the plots with barley, were all of them treated in exactly the same way. The results are given in Tables A and B.

From these experiments it appears that under some circumstances shallow tillage is more profitable than the more extensive loosening of the subsoil. The richer the upper layer, and the better, more compact the subsoil, the greater success will attend the loosening of the subsoil. Making a groove in the bottom of the furrow requires much less expenditure of power than loosening the subsoil over the whole width of the field with a broad subsoiler, so that even with an equal yield the first method would be preferable; but the experiments show that in two cases out of three the plots with the grooves cut in the bottom of the furrow gave more than the plots in which the whole of the subsoil had been loosened. It is probable also that the effects of the first method last longer than those of the second, as the solid balks of earth which remain and support the upper layer prevent the loosened subsoil being compressed again too soon.

B. Friedeberg Experiment Field.
1. Original Ligowo oats.

| Plot | Yield per plot of $\frac{1}{16}$ acre | | Average yield per acre | |
|---|--|-------|---------------------------|-------|
| | Grain | Straw | Grain* | Straw |
| | lbs. | lbs. | lbs. | lbs. |
| low ploughing | 425.5 | 487.3 | | |
| uplicate | 402.3 | 481.8 | 2680 | 3133 |
| low ploughing with groove sub- soiling | 459.7 | 521.5 | | |
| uplicate | 428.8 | 511.6 | 2876 | 3331 |
| low ploughing with subsoiling of whole width | 437.6 | 505.0 | | |
| uplicate | 468.5 | 529.2 | 2933 | 3347 |
| up ploughing | 394.6 | 476.3 | | |
| uplicate | 502.7 | 554.6 | 2904 | 3340 |

2. Original Bethges II barley.

| | | | | |
|---|-------|-------|------|------|
| low ploughing | 377.1 | 426.5 | | |
| uplicate | 387.0 | 458.6 | 2469 | 2858 |
| low ploughing with groove sub- soiling | 384.8 | 457.5 | | |
| uplicate | 401.3 | 503.8 | 2590 | 3468 |
| low ploughing with subsoiling of whole width | 368.2 | 435.5 | | |
| uplicate | 402.4 | 496.1 | 2490 | 3011 |
| up ploughing | 340.7 | 406.8 | | |
| uplicate | 421.2 | 532.5 | 2462 | 3040 |

writer, wishing to investigate the question thoroughly, will repeat experiments for several years and will include in them experiments moisture and bacterial content of the soil.

Possibilities of Profitable Cultivation in the Dry Districts of Ceylon.

BRAND, H. M. (A paper read at the meeting of the Ceylon Board of Agriculture. — *The Tropical Agriculturist*, Vol. XI, No. 2, pp. 100-102, Colombo, Feb. 1913.

on may be divided into three zones : the moist and dry low country and the hill country. Leaving the hill country aside, the moist dry area which is situated in the south-west of the island is where small crops (coconut, tea, rubber, etc.) are cultivated ; the dry low-

land area, which occupies more than half the island, remains for the part either impenetrable jungle or barren waste, except where irrigation water exists or special conditions of underground water obtain. The fall on this dry zone is seldom less than 40 inches and frequently 50 inches, the major part of which falls in the months October-June. This period is followed by a drought, then by a few gentle uncertain rains in April-June, and a further drought.

The chief difference between the dry and the moist area, the latter lies in the failure of the south-west monsoon over the former; in this, the rest of the rainfall is sufficient to raise one crop per annum. Native cultivators do use it to a certain extent for the production of rice under a very primitive system of agriculture. But with the introduction of dry farming methods, the production of other and more valuable crops should be possible.

Of these, two are suggested as specially suitable — the one for fodder to take the place of the large quantities of hay imported from Australia, and the other cotton, which could be planted in October, grow with the rains, and ripen during the unfailing drought of February and March. Preliminary trials indicate that both these crops would be quite successful but more evidence is required before they can be recommended with confidence, so that the necessity of starting experimental farms in the districts is quite evident.

652 - **The Price of Nitrogen.** — BERTRAND, A. (Delegate for the Nitrate of Soda in Europe). *Le Marché mondial de l'azote en 1911 et 1912. Rapport au Ministre des Finances du Chili.* — Reprinted from *L'Engrais*, of March 14 and 21, pp. 12 + VIII graphs. — 2. BRADBURY and HIRSCH's *Review of the Market for Ammonia during 1912*, pp. 37 + 3 tables. London. — 3. *Revue de la Semaine.* — *Les Mercuriales Agricoles*, *passim*. Antwerp, 1913.

Recently there has been a general rise in the markets of the principal fertilizers and especially of nitrate of soda. In fact the prices of soda have risen since 1910 and lately have come very near the quotations of 1906, that is the time of the so-called nitrogen crisis.

According to M. Bertrand the increase in the price of nitrogen before 1906 was attributed to nitrate of soda, should now be attributed to sulphate of ammonia, admitting the manurial equivalence of nitric ammoniacal nitrogen. The increase in the price of nitrogen is, however, considered by M. Bertrand as a special manifestation of the increased prices universally observed and recognised for all the staples of international trade. And if such general rise is due to the diminished purchasing power and to the extent of 30 per cent. between 1910 and 1912 (*J. Fisheries Journal of Economics*, Jan. 1913), starting from the price of 11s per cwt., considered as the normal price of nitrate in 1910, M. Bertrand thinks that the present price of 11s 3 1/2d is still within normal limits.

(1) See: *Production et consommation des engrais chimiques dans le monde.* International Institute of Agriculture, 1913.

BERTRAND - *Le Marché de l'Azote en 1904*

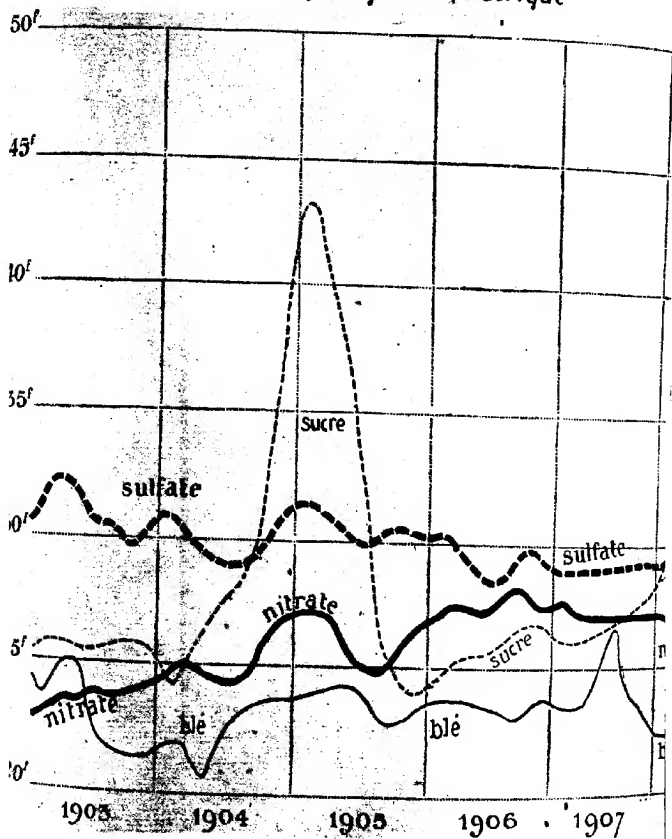
1904

1905

1906

1907

*Lignes des cotes mensuelles
du NITRATE de SOUDE, du SULFATE d'AMMON
du BLÉ et du SUCRE
par quintal métrique*



Range of prices per metric quintal of nitrate of soda (nitro)

confirmation of the above he shows in diagram 1 the fluctuations in price of sulphate of ammonia and of nitrate of soda compared with price of sugar and of wheat (1).

Diagrams 2, 3, 4 and 5 show sufficiently the details of the oscillations in the price of nitrogen in its various forms during 1911 and 1912.

On the above diagrams, M. Bertrand makes the following observations:

a) The lines representing the prices in the various markets of consumption do not deviate so much from each other, while their parallelism with the line representing prices on the coast of Chile is less regular.

b) The yearly rise in the price of nitrate of soda which takes place at the season of consumption was less accentuated during the last two years than in the preceding years.

c) The irregularities and deviations in the sulphate of ammonia markets are relatively more marked.

d) According to diagram 4, it appears that nitrate of lime has a tendency of its own towards an increase in price.

e) In cyanamide, the unit (one kilogram per quintal) of nitrogen is, in Europe, from 1d to 1½d cheaper than in the other nitrogenous fertilizers; in the United States the reverse seems to be the case.

f) Diagram 5 shows that nitrate of soda, referred to the kilogram of nitrogen in part at least, has resumed higher quotations than sulphate of ammonia.

The following figures, taken from Messrs. Bradbury and Hirsch's *Review of the Markets for Sulphate of Ammonia during 1912*, will assist in giving an idea of the present conditions of the nitrogen market.

*Average prices of nitrate of soda, 1903-1912,
in Liverpool, 95 per cent., per cwt.*

| | s | d | | s | d |
|----------------|----|-----|----------------|----|------|
| 1903 | 9 | 6 ½ | 1908 | 10 | 2 ½ |
| 1904 | 10 | 2 ½ | 1909 | 9 | 9 |
| 1905 | 10 | 9 ½ | 1910 | 9 | 4 ½ |
| 1906 | 11 | 4 | 1911 | 9 | 10 ¾ |
| 1907 | 11 | 2 | 1912 | 11 | 1 |

1912.

| | | | | | |
|-----------------|----|------|----------------|----|-----|
| Jan. | 10 | 0 ¾ | July | 11 | 0 |
| Feb. | 10 | 4 ½ | Aug. | 11 | 3 |
| March | 10 | 10 ½ | Sept. | 11 | 5 ¼ |
| April | 11 | 0 ¾ | Oct. | 11 | 6 ¾ |
| May | 11 | 0 ¾ | Nov. | 11 | 9 |
| June | 11 | 0 | Dec. | 11 | 7 ½ |

(1) M. Bertrand has kindly permitted us to reproduce these diagrams.

(Ed.)

Average prices of sulphate of ammonia, 1903-1912,
good grey 24 per cent. f. o. b. Hull., per ton.

| | £ | s | d | | £ | s | d |
|----------------|----|----|---|----------------|----|----|---|
| 1903 | 12 | 9 | 2 | 1908 | 11 | 12 | 0 |
| 1904 | 12 | 3 | 8 | 1909 | 11 | 5 | 0 |
| 1905 | 12 | 10 | 9 | 1910 | 12 | 3 | 2 |
| 1906 | 12 | 0 | 9 | 1911 | 13 | 15 | 3 |
| 1907 | 11 | 15 | 8 | 1912 | 14 | 7 | 9 |

1912.

| | | | | | | | |
|-----------------|----|----|---|------------------|----|----|---|
| Jan. | 14 | 7 | 2 | July | 14 | 3 | 9 |
| Feb. | 14 | 8 | 1 | August | 14 | 7 | 0 |
| March | 14 | 11 | 3 | Sept. | 14 | 8 | 5 |
| April | 14 | 19 | 1 | Oct. | 14 | 2 | 2 |
| May | 14 | 14 | 1 | Nov. | 13 | 17 | 0 |
| June | 14 | 11 | 3 | Dec. | 14 | 3 | 5 |

Messrs. Bradbury and Hirsch recognise the exceptional rise in freight rates, which resulted in an advance of about 50 per cent. in nitrate of soda freights, causing an increase of prices in Liverpool of 6 $\frac{1}{4}$ d more than the Chile coast, but still leaving an ample margin for the producers. Messrs. Bradbury and Hirsch believe that the price of sulphate of ammonia depends at present upon the capacity of the German market to cover the offers of the producers; should it fail to do so, these would be obliged to have recourse to foreign markets.

The following figures based on the wholesale prices at Antwerp are taken from the *Mercuriales agricoles*. They indicate the present trend of the market.

| | Price per kilogram (2.2 lbs.) of nitrogen | |
|-------------------------------|--|------------------------------|
| | End of January 1913 frs. | End of April 1913 frs. |
| Nitrate of soda | 1.82 | 1.65 |
| Sulphate of ammonia | 1.78 | 1.64 |
| Calcium cyanamide | 1.57 | 1.57 |
| Nitrate of lime | 1.76 | 1.82 |

653 - Experiments with Phosphatic Manures in Uruguay, 1907-1912. - SCHROEDER (Agricultural Institute of Montevideo) in *Revista de la Asociación Rural del Uruguay*, Year XLII, No. 2, pp. 94-98. Montevideo, February 1913.

A question which is at present very important for the agricultural economy of Uruguay is that of the use of manures. The analysis of the soils shows a relative poverty of phosphoric acid (for instance, from 0 to 0.05 per cent. P_2O_5 soluble in 25 % hydrochloric acid). These experiments are specially important from the fact that they have been made under a sub-tropical climate and with the phosphatic by-product of the

May Beatos meat factories (bone meal, bone ash, guano) in comparison with basic slag and superphosphate.

Results of the Experiments.

| | Crop per acre — grain — lbs. | Increase per acre — grain — lbs. | | |
|-------------------------------------|---|---|-------------------------|--------------------|
| <i>Maize (1908)</i> | | | | |
| Without manure | 3381 | — | | |
| Bone meal | 4426 | 1045 | | |
| Guano | 4669 | 1289 | | |
| | Roots — lbs. | Dry matter — lbs. | Dry matter — lbs. | |
| <i>Mangolds (1909)</i> | | | | |
| Without manure | 14 698 | 1 793 | — | |
| Bone meal | 49 247 | 5 135 | 3 342 | |
| Superphosphate | 43 715 | 4 384 | 2 590 | |
| Basic slag | 43 403 | 4 749 | 2 956 | |
| | Straw — lbs. | Grain — lbs. | Straw — lbs. | Grain — lbs. |
| <i>Rye (1910)</i> | | | | |
| Without phosphatic manure | 2 855 | 713 | — | — |
| Bone meal | 3 212 | 981 | 357 | 268 |
| Bone ash | 3 301 | 1 070 | 446 | 357 |
| Superphosphate | 3 301 | 981 | 446 | 268 |
| | lbs. | lbs. | lbs. | lbs. |
| <i>Potatoes (1911)</i> | | | | |
| Without phosphatic manure | 4907 | — | — | — |
| Bone meal | 5799 | — | — | 892 |
| Superphosphate | 5977 | — | — | 1070 |

A special experiment was conducted on plots of 63 sq. yards with rye, for the comparison of bone meals of various degrees of fineness :

| | Crop — lbs. | | Increase — lbs. | |
|----------------------------------|-------------------|-------|-----------------------|-------|
| | Straw | Grain | Straw | Grain |
| Without manure | 35.20 | 9.35 | — | — |
| Bone meal, commercial | 38.50 | 11.99 | 3.30 | 2.64 |
| coarse | 38.50 | 10.78 | 3.30 | 1.43 |
| fine | 42.90 | 13.75 | 7.70 | 4.40 |
| very fine | 41.58 | 13.64 | 6.38 | 4.29 |
| Bone ash | 41.25 | 13.31 | 6.05 | 3.96 |
| Superphosphate (Lawes) | 44.00 | 12.76 | 8.80 | 3.41 |

These results confirm the usefulness of phosphatic manures for the soils of Uruguay. The differences observed are within the limits of experimental error. Only coarse bone meal has given, during the first year of the experiments, inferior results, thus corroborating the evidence already obtained in other places as to the influence of the fineness of the meal used.

654 - Calcium as an Antitoxin to Certain Nutritive Salts in Water-Culture Peas and Lupins. — ROBERT, C. in *Comptes Rendus de l'Académie des Sciences*, Vol. 156, No. 11, pp. 915-918. Paris, March 17, 1913.

Pea seedlings, after having been started in pure distilled water (redistilled over glass) were transferred to the following solutions:

- 1) Magnesium sulphate, $MgSO_4$ 250 mg. per litre
- 2) Potassium phosphate, H_2KPO_4 500 mg. per litre
or potassium sulphate, K_2SO_4 containing an equivalent amount of K
- 3) Ammonium nitrate, NH_4NO_3 500 mg. per litre
or ammonium sulphate, $(NH_4)_2SO_4$ containing an equivalent amount of (NH_4)

All such plants immediately ceased to grow and appeared to their medium thoroughly toxic, but when calcium sulphate was added to the proportion of 500 mg. per litre, the toxic effect was completely neutralized; nor did it appear when the seedlings were transferred to a solution of calcium sulphate alone.

The following figures were obtained in two sets of experiments

| | Dry weight in mg. | | |
|-----------------------------------|-------------------|-------|-------|
| | Root | Shoot | Total |
| I. * | | | |
| Redistilled water | 10.5 | 18.5 | 29. |
| $CaSO_4$ | 16.6 | 47.6 | 64.2 |
| $MgSO_4$ | | | 17.6 |
| H_2KPO_4 | 3.1 | 10.5 | 18.6 |
| K_2SO_4 | 7.3 | 16.3 | 23.6 |
| $MgSO_4 + CaSO_4$ | 17.0 | 45.3 | 62.3 |
| $H_2KPO_4 + CaSO_4$ | 12.8 | 45.5 | 58.3 |
| $K_2SO_4 + CaSO_4$ | 14.7 | 42.8 | 57.5 |
| II. ** | | | |
| Redistilled water | 11 | 16.2 | 27.2 |
| $CaSO_4$ | 18 | 38.7 | 56.7 |
| NH_4NO_3 | | | 13.5 |
| $(NH_4)_2SO_4$ | | | 13.7 |
| $NH_4NO_3 + CaSO_4$ | 20 | 39.6 | 59.6 |
| $(NH_4)_2SO_4 + CaSO_4$ | 19 | 36 | 55 |

* Mean weight of 6 seedlings.

** " " " " 8 " "

The experiments lasted 12 days and the temperature varied from 20° to 25° C.

The growth was practically the same whether the calcium sulphate was supplemented by other salts or not, and it would seem, therefore, that salts of potassium, magnesium, and ammonium do not play an important part in the nutrition of the pea seedling during its early development.

The antitoxic effect of calcium with regard to copper was also shown by growing a set of plants in ordinary copper still water, where the following results were obtained:

| | Length in mm. | | |
|-------------------------------------|---------------|-------|-------|
| | Root | Shoot | Total |
| Redistilled water | 64 | 43 | 107 |
| Copper still " | 19 | 36 | 55 |
| " " " + CaSO ₄ | 36 | 83 | 119 |

The experiments were repeated with white lupins, which proved even more sensitive than the peas to the toxic action of the nutritive salts; but, on the other hand, wheat and maize gave far less decided results, and with them potassium salts in the concentrations mentioned above hardly appeared noxious at all. The investigations are being continued.

655 - **Modifications and Mutations of Tuberous Plants.** - LABERGIER in *Bulletin des Séances de la Société Nationale d'Agriculture de France*, Vol. LXXIII, No. 2, pp. 157-161. Paris, 1913.

The writer mentions his previous investigations and those of Eckel and Verne on the mutations which have been observed to occur in *Solanum Commersoni*. These investigations were made in Poitou in 1912 and under unfavourable conditions from the point of view of insolation.

Nevertheless, the following points are worthy of notice: 300 plants were grown in different nutritive media, ranging from pure sand to arable soil, with the addition of 5, 10 and 25 per cent. in weight of a fertilizer consisting of the following substances:

| | Per cent. |
|---|-----------|
| Well-rotted dung | 25 |
| Rabbit dung | 12.5 |
| Chicken guano | 12.5 |
| Horse dung | 10 |
| Leaf-mould and well-rotted dung | 20 |
| Grape pomace and lime | 20 |

The tubers which showed a tendency to mutation in preceding years, when put into pure sand evinced clear signs of retrogression to the wild species, with abundant and prominent lenticels and rough skin; the flowers reassumed their very long styles, their deeply divided corolla, and blunt sepals. While on the other hand forms in contact with *S. tuberosum*, such as Early Rose, Merveille d'Amerique and Violet Commersoni 1-01, maintained their modifications, which were much accentuated by the application of the above-mentioned fertilizer.

Another series of experiments was carried out with wild *S. Commersoni* collected in 1911 and compared with similar tubers gathered in 1910, which had been kept dry. The fertilizer had no effect upon the former, beyond causing a variation in the yield; but the tubers of 1910, which had got very dried up, presented the following characters:

- Pure sand: wild type maintained.
- With 5% fertilizer: wild type maintained with slight modification.
- " 10% " : four round regular tubers, almost without lenticels, modified.
- " 25% " : four round tubers, one almost without lenticels, much modified.

The writer considers that, given a season of full sunshine, the modifications would give rise, as in 1901, 1904, 1906 and 1907 to complete mutations. In any case, the results leave no doubt as to the great effect of vicinity increased by the application of manure.

A third set of experiments showed that 1.1 per thousand of manganese sulphate causes the medium to be infertile and entirely suppresses the development of tubers; with 5 per cent. fertilizer and 0.55 per thousand of manganese sulphate, the tubers were very irregular and few in number; with 25 per cent. of manure, the same amount of manganese allowed a more abundant development of tubers, but these were very irregular if the plants producing them were derived from much modified tubers.

The facts may be summarized as follows :

1) Plants in contact preserve their clear tendency to mutation, and fertilizers increase this action to the point of making the crops resemble in a marked degree the ordinary *S. tuberosum*.

2) Any drastic treatment of the tubers, such as prolonged desiccation, facilitates the action of the fertilizer, which, however, has not so much effect as when it is used in conjunction with contact action.

3) Large amounts of manganese paralyse the property of tuber production, while the effect of a small dose is yet to be determined.

656 - Influence of Radio-activity on Germination. — PETIT, C. and ANCELIN, R. in *Comptes Rendus de l'Académie des Sciences*, Vol. 156, No. 11, pp. 903-905. Paris March 17, 1913.

Seeds of rye grass, wheat and maize were germinated between sheets of damp blotting paper. In one set the water used for damping had a radio-activity of 0.089 mg.-min. per litre, while in a set of controls ordinary water was employed. In each case the radio-active water had a remarkably stimulating effect on the grains, though this effect did not become apparent till about the twelfth day after the commencement of the experiment.

657 - On Cleistogamy in Rice (*Oryza sativa*) and the Possibility of Cross Fertilization. — FARNETI, RODOLFO in *Atti dell'Istituto Botanico dell'Università di Pavia*, Series II, Vol. XII, pp. 351-362, plate XIV. Milan, 1913.

The writer has been able to observe that the pales of rice never open before, during or after the dehiscence of the anthers. Consequently the natural production of hybrids is impossible, even as a chance occurrence. All the varieties and forms in cultivation must have sprung from mutations. The great number of these may be explained by the marked diversity in the conditions of surroundings, climate and cultivation to which rice is subjected.

Rice is therefore a cleistogamous plant, but is exceptional among such in possessing flowers of only one type, with perfectly formed gynoecium and androecium. It is cleistogamous in that no natural internal pressure can open the flowers, as this is mechanically prevented by a hinging of the edges of the two pales throughout their length. This is perhaps a unique type of cleistogamy and presents much interest; it should be noted that

Leersia oryzoides, which is one of the few other cleistogamous grasses, and a marsh plant closely related to rice, presents two types of flowers as is usual in cases of cleistogamy.

It is well known that climate and special conditions tend to modify the mechanism of pollination; it was therefore interesting to find out whether cleistogamy occurs in all varieties of rice and in all places where it is grown, or whether exceptions occur as in other cleistogamous plants, not excepting the species of *Leersia*. An examination was therefore made of 13 varieties of rice grown in Japan, sent direct from Nisigura, and of several varieties indigenous in Italy or introduced at various dates from abroad: not a single exception was found.

The cause of the cleistogamy of rice is presumably hereditary. *Oryza sativa* is a native of river banks and flooded land in Indo-China; in this country during its period of growth torrential rains occur daily, accompanied by flooding of the rivers. If the rice flowers opened, their fertilization would certainly be interfered with, if not prevented.

As natural hybridization is excluded, the writer attempted to find out whether there was any possibility of making artificial cross-fertilization. The practical results obtained by crossing in many cultivated plants, and especially in cereals, are such as to encourage any attempt at hybridizing rice, either by cross-fertilization or grafting. The production of hybrids by the latter means is, however, much disputed. With rice it was attempted as long ago as the beginning of the 18th century by Gianverardo Zeviani of Verona; he was the first to attempt grafting on rice, and indeed on any gramineous plant, with the idea of reinvigorating the species, which he believed to be degenerate. But the grafted plant did not give good results.

In the writer's experiments on hybridizing by artificial cross pollination, all the flowers artificially opened, whether or not the stamens were destroyed, remained unfertilized, while all those not operated on set seed.

He believes the failure was due not to lack of skill, or to the damaging of the flowers, but to other causes which remain to be investigated. He suggests a lack of sufficient moisture of the air within the opened flowers, as evaporation within the naturally closed ones would obviously be very limited. The experiments are to be repeated, and the plants dealt with will immediately be placed in a damp atmosphere, either under bell-jars or in forcing houses.

If the sterility of the flowers artificially opened but not mutilated was due solely to this cause, artificial crossing of rice, though very difficult, cannot be considered impossible. All will depend on the skill and patience of the operator.

658 - **Particulate Inheritance.** — BEARINGHEM, L. Sur l'hérédité en Mosaïque. — *IV Conférence Internationale de Génétique, Paris, 1911*, pp. 101-131. Paris, 1913.

In his works published in 1862-63, Charles Naudin pointed out that the characters of two parent species are not always uniformly distributed in all parts of their hybrid offspring, but that sometimes visible patches of the one parent occur side by side with visible patches of the other parent,

the patches being apparently perfectly pure and free from all mixture, forming a kind of living mosaic. This conception extended to the germ cells supposed that the specific essences never really fused together to form a homogenous whole, but that they remained distinct and were for ever struggling to break away from one another. The tendency of the specific elements of each type to accumulate in visible patches is increased by cuttings and becomes more accentuated as the plant gets older, being especially developed at the time of the formation of the ovules and pollen grains. At such a time, if the separation is complete, returns to the parent species might be obtained amongst the offspring of hybrids. This hypothesis would account for the first hybrid generation being generally uniform, as contrasted with the diversity of types in the second generation, and for the facts of heredity in general, including Mendelian inheritance as a particular case.

Naudin was led to enunciate his principles from a consideration of the results obtained with the hybrids *Datura Stramonio-laevis*, *Linaria purpureo-vulgaris*, *Mirabilis longiflora-Jalapa*, and the writer adds his observations on these plants, and more especially a detailed account of his work on the barleys (*Hordeum distichum nutans* \times *H. distichum erectum*; *H. distichum* \times *H. tetrastichum*; *H. distichum nutans* \times *H. distichum nudum*) and *Pyrus Belloeriana* (sterile hybrid between *Pyrus* and *Sorbus*), which is all confirmatory. He shows, moreover, that the so-called sexual hybrids *Cytisus Adami*, *Crataegomespilus Dardari* and *Assieresii*, the Orange trees *Bizarria*, the almond-peach tree, etc., whose origin is uncertain, could be explained on the same hypothesis, and lastly that the vegetable chimeras of Winkler (1), Daniel's graft hybrids, and Baur's *Pelargonium zonale* all fall into line.

The writer contributes a considerable number of fresh observations on *Cytisus Adami*, and suggests that the name of *Naudinian heredity* should be adopted for this old hypothesis which he has revived.

659 - **The Bearing of Teratological Development in *Nicotiana* on Theories of Heredity.** — WHITE, O. E. in *The American Naturalist*, Vol. XLVII, No. 556, pp. 206-228. Lancaster, Pa., April 1913.

Two strains of *Nicotiana Tabacum* were investigated, the one being a fasciated sport of the other. When crossed there resulted in F₂ a simple Mendelian ratio of 3 : 1 as regards normal and abnormal characters, and with a little practice the heterozygotes were distinguishable. The segregates bred true in the F₃ and F₄ generations.

The cytological examination of the plants showed that the abnormality is exhibited even in the germ cells, and the data as a whole raise a question as to the significance of chromosomes in inheritance.

(1) See No 484, B. May 1913.

- 660 - **Breeding of Vines.** — DERN: In *Mitteilungen des deutschen Weinbauvereins*, No. 12, 1912; summarized by DETZEL: in *Fühlings Landwirtschaftliche Zeitung*, Year 62, Part 5, pp. 181-182. Stuttgart, March 1, 1913.

The writer advises the breeding of vines, not only for the purpose of increasing their productivity but also with a view to making them more resistant to diseases.

At the instigation of the writer, the Bavarian Government has established an Organization for vine breeding; a special official has been appointed for the work. The Society for the Promotion of Plant Breeding in Germany has also made a special section for vine breeding.

- 661 - **The Influence of the Environment on the Milling and Baking Qualities of Wheat in India: No. 2.** — [HOWARD, A., LEAKE, H. M., and HOWARD, C. L. C. — *Memoirs of the Department of Agriculture in India*, Vol. V, No. 2. pp. 49-102. Calcutta, January 1913.

An account of the experiments of 1909-10 and 1910-11, a summary of which has already been published in the Annual Report of the Agricultural Research Institute of Pusa (1).

- 662 - **Soy Beans in India.** — WOODHOUSE, E. J. and SOMERS TAYLOR, C. *The Varieties of Soy Beans found in Bengal, Bihar and Orissa, and their Commercial Possibilities.* — *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. V, No. 8, pp. 103-175. Calcutta, March 1913.

At the present time soy beans are cultivated to a small extent in the Darjeeling Hills, and to no appreciable extent elsewhere in India, but during the years 1909-11 experiments were carried out in Bengal, Bihar and Orissa to ascertain the commercial possibilities of the crop in the plains.

Three definite types of beans have been isolated from native seed and studied. In two cases the oil content was found to be relatively high and the nitrogen content low, while in the other case the reverse occurred; these characteristics were inherited.

The yields obtained usually varied from 650 lbs. to 1 000 lbs. per acre, though under favourable circumstances they rose to 2 200 lbs. per acre; these yields compare favourably with those obtained in Manchuria. The cost of cultivation was estimated at 13s to 20s per acre, though it might rise to 27s per acre. Under these conditions, prices of £ 5 8s to £ 5 17s per ton are required to make the crop remunerative; for the present such prices are not to be obtained, £ 4 10s being offered by merchants in Calcutta. But there can be no doubt that the crop is intrinsically worth more than this, and signs are not wanting that its value as a food stuff is being appreciated, so that a considerable rise in prices is not unlikely.

The varieties used in the experiments occupied the land for two seasons in the plains and the crop had therefore to pay double rent. Efforts will now be concentrated on the production of new varieties combining the qualities of early maturity, productiveness, and high oil content, and if these attempts are successful, the projects of making the crop a remunerative one in India will be far more hopeful.

(1) No. 357, B. April 1913, gives an abstract of this article. (Ed.)

663 - **The Sweet Potato and its Cultivation.** — MATTEI, G. E. in *Bollettino del R. Orto Botanico e Giardino Coloniale di Palermo*, Vol. XI, Part 1-2-3, pp. 3-17, Palermo, January—September, 1912.

After giving some information respecting the origin and history of the sweet potato and a description of its biological characters, the writer deals with the cultivation and utilization of this tuber. He calls to mind the uncertainty which still exists as to the origin of this species, which has so far never been found wild in any part of the globe and has therefore been attributed by several botanists to different genera.

Choisy called it *Batatas edulis*, thus changing the name of *Convolvulus Batatas* given to the plant by Linnaeus and creating a new genus; now the sweet potato is identified under the name of *Ipomoea Batatas* Poiret; it was considered by Asa Gray to be the cultivated form of *I. fastigiata*.

It has a number of popular names in America: "Ajes" in the West Indies, "Camotes" in Mexico, "Jatica" in Brazil, "Apichu" and "Skinet" in Peru. In Asia and Africa, the natives use names which cannot always be attributed with certainty to this plant alone; the most certain are "Dankali", "Kitaiti" and "Veezee", which are current in Central Africa.

The sweet potato requires an equable, sub-tropical climate; nevertheless it grows at high altitudes in temperate and nearly cold regions, such as Venetia in Italy, where it is extensively cultivated. The soil must be very thoroughly worked, but not too deep; it requires liberal supplies of potash and green manures, farmyard manure, cotton cake, etc., should be given. It is multiplied by slips or "draws", the latter being the safer method. In both cases, the soil should be made into ridges 2 feet apart; on these the plants are placed in one line, at intervals of 1 foot.

In hot climates, the tubers attain their complete development three months after planting, while in Italy, even if they are placed in the ground at the most favourable date, the beginning of April, the crop cannot be dug until October. Under ordinary conditions and in temperate countries, the average yield is about 1 lb. per plant and 7 or 8 tons per acre.

The sweet potato is especially grown as an article of food and is much appreciated in hot countries; in Brazil, it is used for the preparation of an alcoholic beverage. The tubers contain from 15 to 30 per cent. of starch which is easily extracted; this has lately been put on the market under the name of "Brazil Arrowroot". They also have 12 per cent. of sugar but the latter is difficult to isolate owing to the presence of glucose. The very young stalks are eaten as a vegetable, the harder, stringy ones making good forage. The sweet potato is employed in the preparation of syrup and its content of sugar only extracted with difficulty, together with its richness in starch, make it an excellent raw material for the alcohol industry.

Pasture Problems: Drought Resistance. — STAPLEDON, R. G. (Agricultural Department, University College of Wales, Aberystwith) in *The Journal of Agricultural Science*, Vol. V, Part 2, pp. 129-151. Cambridge, March 1913.

The effect of the drought of 1911 on some pastures in the Cotswold district was studied by making quantitative and qualitative analyses of the herbage at various periods of the year, and observing the behaviour and power of resistance of a large number of its constituent species.

365 — **Teff (*Eragrostis abyssinica*).** (1) — BURTT-DAVY, J.: in *The Agricultural Journal of the Union of South Africa*, Vol. V, No. 1, pp. 27-37. Pretoria, January 1913.

The writer, who introduced the cultivation of teff as a forage grass into the Transvaal in 1903, gives an account of its history in that country, and shows how slowly the crop came into favour in spite of favourable reports on trials made in Natal as far back as 1887. It has now proved itself a complete success and is fast becoming a staple hay crop throughout civilized Africa, its qualities being: palatability, high nutritive value, heavy yield, rapid growth, drought resistance, and ability to smother weeds. The experience of the Transvaal might well be repeated in India and Australia where preliminary trials proved satisfactory, but where the subsequent popularization has not yet occurred.

666 — **Russian Cotton.** — TARIS, E. in *L'Agriculture Pratique des Pays Chauds*, Year 13, No. 119, pp. 89-111. Paris, February 1913.

During the months of April to September 1912, a Commission was sent from the French Colonial Office to travel through Turkestan and Transcaucasia in order to make an enquiry into the general conditions of agriculture of those countries, more especially with regard to the cultivation of cotton, and the developments that are likely to take place in the production of that article. Starting from Poti and Batum on the Black Sea, the Commission travelled east through the entire tract of country as far as Kokand and the Ferghana Province, gathering information directly from agriculturists, and statistics from the Director of the Domain at Tashkent, the Committee of the Stock Exchange at Kokand, agricultural engineers in Turkestan, and the Director of Water Inspection in Transcaucasia.

I. *Turkestan* consists of two distinct regions: the one, in the North, an immense plain, arid and desert with the Ural Sea as a central depression; the other, in the South, mountainous and more fertile. The latter is traversed by two principal rivers, the Syr-Daria and the Amu-Daria, which are over 2 000 versts (1326 miles) long and on which the prosperity of the country chiefly depends; the province of Semirychensk (just South of the Lake of Balkash) is the only well watered district in the country. The climate is typically continental, i. e. subject to great extremes, and the average rainfall varies from 5.2 in. to 12.6 in., rising to 22.8 in. in the Province of Semirychensk.

The soil consists of a very thick layer of loess clay, which forms a fine yellow-white dust during the summer and dries with a very hard crust when

(1) See also No. 2107, B. July 1911.

•(Ed.).

wetted, occasionally making germination very difficult. Needless to say, cultivation is only possible where irrigation is practised, and as the water supply is limited, the area under crops only represents 1.8 per cent. of the total area of the country and is restricted to the river valleys. However, with better management of the water supplies it would doubtless be possible to extend the cultivated area very largely, and were this accomplished, the annual rainfall might also increase gradually, for old traditions of the tenth century indicate that much of the country which is now a desert was at one time productive.

The crop distribution in 1909 was as follows :

| | Acres | Per cent. of cultivated area |
|-------------------|-----------|---------------------------------|
| Wheat | 3 891 225 | 47.5 |
| Rye | 80 589 | 1.0 |
| Barley | 761 270 | 9.4 |
| Oats | 379 138 | 4.6 |
| Millet | 526 275 | 6.4 |
| Maize | 392 966 | 4.8 |
| Cotton | 798 026 | 9.7 |
| Rice | 457 748 | 5.6 |
| Peas | 45 433 | 0.6 |
| Linseed | 134 084 | 1.6 |
| Lucerne | 621 599 | 7.6 |
| Others | 101 526 | 1.2 |

The area in cotton is small and unequally distributed amongst the provinces, Ferghana producing 111 080 tons out of a total of 176 600 tons. The cotton is ginned in Turkestan, where numerous factories exist, not only for ginning purposes, but also for dealing with the seed and its products. The lint is all exported to Russia, where it is woven into cloth and then reexported for the most part to the Turkestan markets. It is hoped, however, that this uneconomical state of affairs will not persist much longer and that cotton mills will shortly be established in Turkestan itself.

Difficulties of transport are immense in Turkestan and are a serious charge on the exported cotton. There exist two railway lines : one, the Orenburg-Tashkent which comes from the north, touches the Ural Sea and then follows the Syr-Daria to Tashkent, and the other starting at Krasnovodsk on the Caspian Sea and running west to Andidjan (Ferghana). Freight to Moscow vary from £ 6 5s to £ 7 8s per ton, and to this must be added the cost of conveying the goods from the market to the railway line, which may amount to £ 6 16s per ton. High freights impede the development of cotton cultivation in yet another way, for they constrain every district to produce its own corn before turning its attention to other crops, and consequently those parts which are specially adapted to the growth of cotton cannot devote as large an area to it as they otherwise would.

The economic situation of the native cultivators too, is unsatisfactory, for they possess little knowledge of the cotton crop and insufficient capital; many who have embarked on its cultivation have fallen into the hands of

ers, getting more and more into debt every year. But, should steps be taken: 1) to relieve this situation by the organization of credit societies, 2) to improve transport, and 3) to create experimental stations for the guidance of the native cultivators, the profitable cultivation of cotton is capable of immense development, and having satisfied the demands of the Russian market, a large surplus of medium quality American Upland cotton could be sent on to the other European markets.

II. *Transcaucasia* is a far richer country than Turkestan, more densely populated, and more varied in every way. It is essentially mountainous, besides mineral riches possesses a fertile soil, a good climate, and a plentiful rainfall. Vines, fruits, tobacco, tea, maize, cereals are all cultivated. The districts suitable to cotton are in the south-east, in the valley of the Aras and the Kur, where the rainfall is smaller and irrigation being practised. Cotton is a far less important crop in this country than in Turkestan. It has only been introduced about 10 years and plantations are not numerous, being still in the experimental stage. But it is safe to say that Transcaucasia would easily produce as much cotton as is being produced in the whole of Turkestan to-day, and moreover its geographical position is far more favourable for reaching the European markets. For the present, however, no considerable output from that quarter is to be expected.

— **The Cotton Industry of Northern Nigeria.** — *Bulletin of the Imperial Institute*, Vol. XI, No. 1, pp. 70-79. London, January-March 1913.

"Cotton has long been cultivated by the natives of Northern Nigeria, the markets of the more northern parts have been frequently visited by caravans from North Africa in order to obtain the cotton used in the weaving industry of that part of the continent. Hitherto transport difficulties have prevented the cotton of the northern districts being exported to the United Kingdom, but the completion of the Baro-Kano railway will enable this vast and populous area to be tapped. Up to the present the efforts to encourage cotton cultivation amongst the natives have been confined to the Niger and Benue valleys, and with this end in view the British Cotton Growing Association erected ginneries at Lokoja, at the junction of the Benue and Niger rivers, and at Ogudu on the Niger in the Ilorin province. More recently a large ginney has been erected at Zaria, further north. The Ogudu ginney, however, was closed on the opening of the Lagos Government Railway, the cotton from this district being ginned in Northern Nigeria."

"In the Kano and other northern districts, the indigenous cotton is not stapled with white lint, whilst that of the Benue and Niger valleys is stapled with tinted lint. Plantations have been formed by the British Cotton Growing Association at Lokoja and Ogudu, where experimental work has been carried out on the acclimatisation of exotic seed, selection of native seed and varieties, rotation of crops, time of planting, comparative tests of varieties, cultivation by draught animals, etc. Exotic cottons have also been experimentally cultivated at some of the local farms."

"Complete statistics of the exports of cotton from Northern Niger are not available, but some idea of the production may be gained from the following figures, showing the quantity of unginned cotton purchased by the British Cotton Growing Association and by merchants in recent years:

| | | | |
|----------------|-------|----------------|-----|
| 1904 | 156 | 1908 | 152 |
| 1905 | } 362 | 1909 | 375 |
| 1906 | | 1910 | 111 |
| 1907 | 368 | 1911 | 230 |

A collected report is given of the samples received for examination since 1909. Out of a total of 14 samples, 12 indigenous varieties and 2 improved American Upland were valued as approximately equal to the current price of "middling" American, while a second improved American Upland variety was valued at 9d per lb. with "middling" American 6.60 d per lb.

668 - **Cotton in Egypt and the Anglo-Egyptian Sudan.** — SCHANZ, MORITZ. *Beihfte zum Tropenpflanzer*, Vol. 14, No. 1-2, pp. VII + 180. Berlin, February 19

In the above double number of the supplement to *Der Tropenpflanzer* the writer gives a brief historical review of cotton cultivation in Egypt; he then deals with the natural and economic conditions of 1) Egyptian and Sudanese agriculture in general (soil, climate, irrigation, tillage, schools and associations, forms of tenure, credit systems); 2) the cultivation of cotton in both countries (especially: varieties of cotton, seed cotton and seed breeding, cotton growing, pests of the crop, profits, uses, and export and import of cotton).

669 - **The Distance apart for Sugar Beets. Experiments in Hungary.** — JANKÓ, BÉLA. in *Mezőgazdasági Szemle*, Year XXXI, Part 4, pp. 192-194. Budapest, April 19

The high cost and bad conditions of labour in Hungary oblige farmers to have frequent recourse to the use of agricultural machines. In sugar beet growing, horse-hoes are much employed and are very useful, not only because they do the work more cheaply than hand labour, but also because there is frequently a deficiency in labourers. It is obvious that the greater the distance between the rows, the more successfully horse-hoes work even when in the charge of unskilled labourers. Hungarian farmers are beginning to find that the usual space of 14 3/4 ins. between the rows is not sufficient, and already some of them are trying to exceed it. The present question under discussion is whether, and how far, this limit can be safely exceeded in Hungary, without decreasing the quantity or quality of the crops.

In order to solve the problem, the Royal Hungarian Agricultural Station has made experiments on 13 estates according to the following plan:

TABLE I.

| Plots | Distances | |
|---------|-------------------------|---------------------------|
| | between the rows in. | between the plants in. |
| 1 and 5 | 14 $\frac{3}{4}$ | 8 $\frac{1}{4}$ |
| 2 » 6 | 16 $\frac{3}{4}$ | 8 $\frac{1}{4}$ |
| 3 » 7 | 17 $\frac{3}{4}$ | 8 $\frac{1}{8}$ |
| 4 » 8 | 25 | 8 $\frac{1}{4}$ |
| 9 » 13 | 14 $\frac{3}{4}$ | 12 $\frac{3}{4}$ |
| 10 » 14 | 16 $\frac{3}{4}$ | 12 $\frac{3}{4}$ |
| 11 » 15 | 18 $\frac{3}{4}$ | 12 $\frac{3}{4}$ |
| 12 » 16 | 25 | 12 $\frac{3}{4}$ |

As is seen, the tests served for the comparison of four different distances between the rows and two between the plants. *The minimum distances were taken as 14 $\frac{3}{4}$ by 8 $\frac{1}{4}$ in, these being the usual distances Hungary.

TABLE II.

| Names of estates | Experiment Plots | | | | | | | |
|-------------------|---|---|---|--|--|-------------------------------------|--|--------------------------------------|
| | 120 sq. in. 14 $\frac{3}{4}$ × 8 $\frac{1}{4}$ | 137 sq. in. 16 $\frac{3}{4}$ × 8 $\frac{1}{4}$ | 153 sq. in. 17 $\frac{3}{4}$ × 8 $\frac{1}{4}$ | 184 sq. in. 14 $\frac{3}{4}$ × 12 $\frac{3}{4}$ | 208 sq. in. 16 $\frac{3}{4}$ × 12 $\frac{3}{4}$ | 205 sq. in. 25 × 8 $\frac{1}{4}$ | 213 sq. in. 18 $\frac{3}{4}$ × 12 $\frac{3}{4}$ | 213 sq. in. 25 × 12 $\frac{3}{4}$ |
| restieg | 1 | 1 | 1 | 4 | 6 | 5 | 3 | 10 |
| renes | 1 | 1 | 1 | 7 | 8 | 1 | 8 | 7 |
| afalu | 1 | 3 | 6 | 4 | 5 | — | 10 | — |
| gytelek | 1 | 1 | 3 | 3 | 5 | 8 | 10 | 10 |
| ósegy | 3 | 4 | 4 | 1 | 1 | 6 | 1 | 4 |
| lánta | 2 | 1 | 2 | 1 | 1 | 5 | 5 | 4 |
| ny | 2 | 1 | 1 | 1 | 2 | 3 | 2 | 4 |
| eske | 3 | 1 | 5 | 6 | 8 | 5 | 10 | 6 |
| ld | 3 | 1 | 1 | 1 | 1 | 3 | 4 | 3 |
| te | 1 | 1 | 1 | 1 | 2 | 3 | 4 | 5 |
| páca | 2 | 2 | 3 | 1 | 3 | 4 | 3 | 7 |
| hely | 1 | 1 | 2 | 1 | 1 | 3 | 1 | 3 |
| out | 3 | 1 | 2 | 1 | 1 | 1 | 3 | 2 |
| Average | 1.84 2 | 1.46 1 | 2.46 3 | 2.46 3 | 3.38 4 | 3.61 6 | 4.92 7 | 5.00 8 |

Table II gives the average results of the experiment plots. The latter were numbered in the following manner: differences in the crop of less than 5 per cent. were not taken into consideration, but were noted down. Crops 5 per cent. below the maximum were numbered 1; those from 5 to 10 per cent. below, 2; those 10 to 15 per cent. below, 3, and so on.

The columns are arranged according to the increasing distances.

According to this table, the maximum crop was obtained with a distance of $16\frac{3}{4} \times 8\frac{1}{4}$ in., while larger distances gave considerably lower crops. It is interesting to note that, with the same space between the rows, the yield was inversely proportionate to the distance between the plants in the rows. A distance between the rows of 25 in. caused a reduction in the crop, even when there was no drought. A slight increase in the distance had no bad effect on the sugar-beets, but if the space was further increased, the quality of the beets suffered in proportion. Finally, the experiment proved that with the distance of $16\frac{3}{4} \times 8\frac{1}{4}$ in. a better crop can be obtained than with that of $14\frac{3}{4} \times 8\frac{1}{4}$ in. which is usual at present in Hungary. Nevertheless, the writer is of opinion that the question of distance depends upon climatic conditions and upon the quality of the soil. Thus, in a district with more frequent rainfall and where the soil is richer in humus, the space of $16\frac{3}{4}$ in. between the rows is too much, and beets grown under these conditions do not thrive so well.

He advises every farmer to make experiments to decide the best distance to be adopted in his special case.

670 - The Use of Commercial Salt as a Fertilizer for Sugar Beets in Hungary. — JANCsó, BELA in *Köztudak*, Year 23, No. 23, pp. 808-809. Budapest, March 22, 1913.

The wild form of the cultivated beet is *Beta maritima*, which is found growing in saline soil and in a salt-laden atmosphere on the coasts of Europe. This fact led experimenters to try whether mangolds and sugar beets took kindly to the application of kitchen salt as a manure. In order to test the effect of this fertilizer, the Royal Agricultural Station at Magyaróvár began a series of experiments in 1909, using however commercial salt instead of the kitchen article, as being less expensive. The experiments of 1909 and also those of 1911 showed that, under certain conditions, the beet reacts satisfactorily to the application of this substance, but that if the soil is too heavy, the salt easily gives rise to cracks, which hinder the development of the plant.

By order of the Ministry of Agriculture, these experiments were continued last year on the State Domains and at the Agricultural Schools. The writer summarizes the results of 23 experiments arranged in four groups:

I. Experiments on sugar beets on eight estates with heavy claysol using 315 lbs. of commercial salt per acre. In four cases the salt increased the crop, in three it had no effect upon it, while in one the result of the application of the fertilizer was to reduce the yield.

II. Experiments at seven different places using 235 lbs. of commercial salt per acre. Here also the crops were increased in four cases. On the Ácsa State Stud farm at Gödöllő, on the contrary, the yield of the control plot exceeded that of the salted plot by 600 lbs.; but owing to the drought prevailing during August and September, the heavy clay soil of this estate only yielded a very poor crop.

III. Four experiments using 160 lbs. of salt per acre; of these two gave good results; in the case of the others, which were on loose sandy soil, the salt had no effect.

IV. Experiments with different amounts of salt. The results obtained show that, in order to increase the beet crop, at least 160 lbs. of salt per acre must be applied; if the amount is raised to 320 lbs. its action is more efficacious. On the Fogaras State Stud farm the fertilizer was applied between the rows. This experiment showed that 160 lbs. of commercial salt applied in this manner have a more noticeable effect than 320 lbs. broadcasted.

All these experiments therefore show that this inexpensive compound when, under certain conditions, increase the sugar beet crops, but it must be used with caution where the soil is heavy.

71 - **The Date Sugar Industry in Bengal.** — ANNETT, H. E. in *Memoirs of the Department of Agriculture in India*, Vol. II, No. 6, pp. 282-389. Calcutta, March 1913.

Out of a total of 3 000 000 tons of raw sugar or 'gur' produced annually in India, at least one-tenth, or 300 000 tons, and probably more, is produced from palms, so that the industry is still a considerable one, though it seems to have declined somewhat of late years in favour of imported products from Java. Bengal accounts for about a quarter of the total produce, and the writer made an extensive study of the agriculture of the date palm (*Phoenix sylvestris*) in the Jessore District, including methods of cultivation and tapping, and of the manufacture of raw and refined sugars.

The yield per tree varied considerably both with individual trees and with plantations, but 170 lbs. of juice may be taken as an average yield per tree throughout the date sugar districts; this estimate is considerably lower than any which have been made previously. On boiling down, 170 lbs. of juice forms 21 $\frac{1}{4}$ lbs. of gur, and with 240 trees to the acre, 2.3 tons of gur may be obtained per acre, a higher yield than can be obtained from cane in the same districts.

The raw juice contains 8 to 14 per cent. of sucrose, associated with practically no glucose; but, owing to imperfect methods of collection, 12 per cent. of glucose is formed during the process. The boiling is carried out in small earthenware pots, and results in a loss which may amount to 20 per cent. of the sucrose, while the refining processes cause further stage. Each cultivator possesses his own primitive boiling plant, and gur is the staple marketable commodity. Large quantities are consumed locally, and the surplus is sold to middlemen who either transport it to more distant parts for direct consumption, or sell it to native refineries. Calcutta is the chief market, and large quantities are there made into

sweatmeats. The refined sugars are mainly consumed by the richer classes of natives, and the molasses are used for making rum and for mixing with tobacco.

Simple and inexpensive reforms are suggested by the writer, more especially with regard to the tapping, but also in the boiling and refining processes. These should effect great improvements. Judging from the success obtained by improved methods employed in the Maple Sugar Industry in America, where a juice containing only 3 per cent. of sucrose is exploited, a little expenditure of capital in the date sugar industry in India would yield ample returns.

672 - **The Recent Evolution of the Exploitation and the Industry connected with the Oil Palm.** — BRET, M. C. in *Journal d'Agriculture Tropicale*, Year 13, No. 140, pp. 42-47. Paris, February 28, 1913.

The exploitation of the oil palm has, under European guidance, evolved from a home industry into an important commercial undertaking. The origin of this movement is to be sought in the reputation enjoyed by certain districts for possessing oil palms (*Elaeis*) which might be from 10 to 30 times more reproductive than they actually are at present.

The native palm groves receive no care, and the method of their exploitation leaves much to be desired; often the stands spring up after forest lands have been cleared, and their ownership is doubtful; sometimes the groves remain unexploited on account of the small number of the inhabitants. In order to prevent this loss, the Governor of the Ivory Coast first tried to induce immigration into the thinly populated rich districts from those which were poor and densely populated, but the practical difficulties entailed prevented the scheme being extended to other districts. It has been attempted with some measure of success to render the exploitation more intense by distributing among the natives little machines for crushing the nuts and thereby extracting more oil. The conditions obtaining prove the possibility of European industrial exploitation, but this could only exist in stands which are sufficiently extensive and rich to provide work for a factory, so that districts must be selected in which the biological conditions are the most favourable.

An attempt has been made to co-operate with the native worker by obtaining the sole right in certain zones of treating the fruit mechanically thus forcing the former to sell their produce to the factories. This method, which is at variance with the usages of the natives, has not proved wholly successful. Installations based on this arrangement exist in the Kamerun and in Southern Nigeria; they are instituted by special legislation on the Ivory Coast and the Gold Coast.

The purchase from the natives of land bearing palm trees is a matter of great difficulty owing to the possession in common and various legal and administrative hindrances. Fairly remunerative contracts have been drawn up on the Ivory Coast by which the right of gathering the nut has been ceded for a certain period of time.

Success can only be obtained by companies possessing capital sufficient to tide over the difficulties which are inevitable at first. According to the writer, success lies in the direction of systematic planting and the subsequent establishment of factories.

73 - **The Cultivation of Rubber Trees in West Africa.** — CHEVALIER, AUGUSTE in *Journal d'Agriculture Tropicale*, Year 13, No. 140, pp. 33-37. Paris, February 28, 1913.

The writer publishes some notes respecting the cultivation of different rubber-producing trees in West Africa and lays stress on the fact that the annual output of rubber in Tropical Africa has remained stationary for some years, so that it is high time that energetic measures were taken to make plantations.

After reviewing the results obtained in the different regions of West Africa with *Manihot Glaziovii* and giving the data collected regarding the yield from tapping, the distances between the trees, and the selection of seed, he recognizes the fact that the value of this tree for plantations in West Africa has not yet been determined. He suggests that all the trials should be made again, using seed from improved trees grown in German East Africa, since this colony possesses trees whose yield is well above the average and which can be tapped from two-and-a-half years, yielding throughout most of the year.

74 - **Method of obtaining Tall-Growing Trees of *Manihot Glaziovii*.** — ZIMMERMANN, A. in *Der Pflanzler*, Year IX, No. 1, pp. 16-18. Darussalam, January 1913.

The writer has made a number of experiments, both at Amami and in other plantations, for the purpose of ascertaining the best methods of inducing height in such plants of *Manihot Glaziovii*, as, by reason of unfavourable climatic conditions or other undetermined causes, flower too early and thus ramify at an insufficient distance from the ground.

The following are the results of one of the experiments made at Amami:

The trees used had been planted in April 1911 and had mostly branched very low down. In September 1911, they were pruned in three different ways: 1) topped at 12 to 16 in. from the ground; 2) topped immediately below the lowest bifurcation; 3) at each point of ramification all the branches were removed, except the one nearest the stem; a month later the fresh shoots were treated in the same way. A fourth lot consisted of plants raised in the nursery and planted out in September 1911 in the place of dead trees, or such as were not growing well.

It was found that the trees of the third group, which had grown zigzag as a result of the pruning, never became straight, although they were young and the side shoots were constantly cut off. Further, the terminal shoots, when once flowered again and gave rise to new ramifications. Thus, by this means no perceptible increase in the length of the stem is obtained. In the case of the trees of the second lot, new shoots at once made their appearance: these were all removed except the most vigorous, which grew in perfect line with the stem, in such a manner that the point of junction

became less and less perceptible. These trees began to branch again much more rapidly than those of the first lot, of which the stems were the highest of these three groups (averaging respectively 5 ft. 6 in., 3 ft. and 4 ft.).

The results obtained with the fourth lot were slightly more satisfactory; under the influence of favourable climatic conditions, these produced very tall stems (5 ft. 8 in.). The average circumference at 3 ft. in the four lots was $8\frac{1}{4}$, 10, 10 and $7\frac{1}{2}$ in. respectively.

In conclusion the method most to be recommended is the topping of the stem at 12 or 16 inches from the ground, which should be done as soon as the first branching begins.

675 - **The Results of Szeged Tobacco Selection in Hungary.** — SZÉKÉCS, ELENY in *Magyar Dohányfajta*, Year XXX, Nos. 6 and 7, pp. 2-4 and 2-3. Budapest March 20 and April 5, 1913.

It is more difficult to select tobacco by the pedigree system than it is to select cereals by the same method, for in the case of the latter, the seeds themselves are the commercial product and can be compared with the best varieties, while with tobacco it is the leaves which are the object of selection. As the leaves of the plants grown for seed production lose all their substance it is only possible to decide from the leaves of the second generation whether the parent plants had been well chosen and were suitable for reproduction. In order to shorten this long process, the writer, at the time of the first selection experiment with Szeged tobacco in 1899, tried the following method: he removed all the flowers from the parent plants, except the top one which is the first to open. In this way, the plant does not exhaust itself in seed development but some of the sap is left for the use of the leaves, which retain their good quality and can be judged on the parent stem.

This experiment was successful: The parent plants ripened their single seed capsule completely; the leaves were gathered when mature, dried and sorted plant by plant, and valued before being made up into bundles. It was at once possible to observe among the leaves the greatest differences in form, size, colour, weight, texture, elasticity and combustibility.

In 1910, when the estate of Arpadhalom was entrusted, under the direction of the writer, with the cultivation of Szeged tobacco for the district of Békéscsaba, the experiments were resumed. In addition to the unselected seed chosen by the Government, he took the 25 parent plants of which the leaves best showed the characteristic qualities of Szeged tobacco. After proceeding in the manner described above he sent the leaves of each stem, made up in different bundles, to the Royal Experiment Station of Tobacco Cultivation at Debreczen, where they were submitted to chemical analysis. After minute analysis, 5 of the 25 parent plants were pronounced suitable for propagation. In 1912, these 5 pedigree families produced sufficient seed to sow about $4\frac{1}{2}$ acres, so that in 1913, all the growers of the Békéscsaba district were able to grow exclusively pedigree tobacco. Furthermore, 5 "métayer" tenants on the estate planted on their land plants belong

to the same 5 pedigree families; each cultivated a separate family in the yield.

The writer gives a very detailed table showing the results obtained with pedigree and with unselected tobacco; the different columns give the areas, the yield of leaves and their classification, the average gross return, and the returns per acre.

| | Selected families | Unselected tobacco | Excess due to selection |
|--|-------------------|--------------------|-------------------------|
| Average yield per acre | 1632 lbs. | 1569 lbs | 63 lbs. |
| Gross return per acre (sale price). £16-13-0 | | £15-1-8 | £1-11-4 |
| Average sale price per lb. . . . | 2.45d | 2.31d | 0.14d |

M. Marton Liebhart, who is attached to the Station, established that the individual characters of each family were most striking, and that selected plants infallibly transmitted their physical characteristics. If, however, the crop was less than had been hoped, this was due partly to a bad autumn, and partly to the tenants, who were not of one mind with the cultivators, and their carelessness and obstinacy had an unfortunate result on the crops. In order to encourage emulation and to induce the tenants to work more harmoniously with the cultivators, the writer suggests that annual prizes could be given by the Tobacco Departement to those tenants who obtain the best results. Nevertheless, those hitherto obtained are sufficient to show that a great impetus has been given to tobacco growing in Hungary, thanks to pedigree selection.

The writer proposes to continue the minute comparison of the five families already existing and to improve other selected types, in order to obtain other pedigree families.

76 - Experiments on Growing Coffee under Shade. — BERTONI, MOISÉS S. Experimentos sobre la Resistencia del Cafe á la Maleza y su Crecimiento á la sombra de Árboles. Primera Serie: de 1909 a 1912. — *Agronomía, Boletín de la Estación Agronómica de Puerto Bertoni*, Vol. V, No. 3-4, pp. 119-128. Puerto Bertoni, Paraguay, January and February 1913.

This bulletin gives a preliminary report on a series of experiments carried out from 1909 to 1912.

The writer, having observed that coffee plants grow very well in company with all wild plants, except Gramineae and Compositae, set himself the task of ascertaining whether, by taking advantage of this fact, it would be possible to save the expense entailed by hoeing. To this end, he planted the yearlings among the trees of a thinned virgin forest. He made four plots, which were hoed 1 to 4 times respectively in the year, and in each of which there were plants with much, little, and hardly any, shade. The experiment showed that those plots succeeded best which were only hoed once or twice (provided there were not many grasses or composites present).

This was the case under the conditions prevailing in Paraguay, *i. e.* with an annual rainfall of from 1500 to 2500 mm. (60 to 100 in.) and 70 to 30 centimetric degrees as the absolute annual maximum.

The writer concludes that in Paraguay shade is indispensable to coffee plantations (though he allows that elsewhere a herbaceous intercalary crop giving no shade might be the best). The depth of the shade should depend on the number of hoeings, but the protection is most necessary even if the plot is only hoed once. Shade is requisite for coffee trees of all ages; it is doubtful whether Leguminosae always afford the best protection; the writer obtained the best results with species of *Guarea* (Meliaceae) about 10 ft. high and the worst with *Lippia virgata* (Verbenaceae), or "Niño-rupá" about 6 ft. 6 in. in height.

677 - **Pepper Production and Trade in Siam.** — *Ministère des Colonies, Bulletin Office Colonial*, Year 6, No. 63, pp. 77-79. Melun, March 1913.

Only two kinds of commercial pepper are recognized in Siam: — white and black. Nevertheless, of late years it has become the habit in some provinces to distinguish four qualities of black pepper; the first consists of only perfect seeds, round and full, and the fourth of small or broken seeds and fragments, the second and third being intermediate. The following table gives the average price of pepper at the place of production for the years 1911-1912.

| | ticals per picul | pence per lb. |
|---------------------------------|---------------------|-------------------------------|
| White pepper | 56 | 7 ¹ / ₄ |
| Black pepper: 1st quality . . . | 36 | 5 |
| " " 2nd " . . . | 32 | 4 ¹ / ₂ |
| " " 3rd " . . . | 23 | 3 ¹ / ₄ |
| " " 4th " . . . | 13 | 1 ¹ / ₄ |

The tax on transit in the interior is 1.25 tical per picul (about 1 ¹/₄ per 10 lbs.) in the case of white pepper, and 1 tical per picul (1 ¹/₂ d per 10 lbs.) for black. In 1911-1912 (the Siamese year begins on the first of April) the total export of pepper from Siam was 34270 piculs (4 569 3 lbs.), worth 1 193 297 ticals (£ 919 933). The port of Bangkok exported 24 200 piculs (3 226 700 lbs.), worth 921 174 ticals (£ 710 072), while Pak exported 10003 piculs (133 700 lbs.), worth 271 827 ticals (£ 209 54). The chief buyers of Siamese pepper are England (13093 piculs = 1 754 7 lbs. in 1911-1912) and the United States (2291 piculs = 305 460 lbs. in 1911-1912). During the same year, 4677 piculs (623 500 lbs.) were sent to Singapore and 2367 piculs (315 600 lbs.) to Hong Kong.

678 - **Experiment Field for Strawberries at Rétfalu, Hungary.** — *HÉBERIS, AIN in Magyarország Szemle*, Year XXXI, No. 4, pp. 186-188. Budapest, April 19

In the wooded mountainous country of the commune of Rétfalu (Gron County), fruit growing has for many years been the principal source of revenue of the inhabitants. In the last 15 years, however, such impetus has been given to strawberry growing that 250 to 300 tons of the fruit, worth over £10 000, are sent annually to the Vienna market. The remarkable result has caused the Ministry of Agriculture to take every possible measure to still further increase strawberry cultivation, especially by improving the quality and introducing varieties which can supply the

set from the commencement of spring to the end of autumn. The study decided to lay out an experiment field for the purpose of spreading practical knowledge respecting improved methods of cultivation and for acclimatisation of different varieties of strawberries and the distribution of proved kinds to growers.

The preliminary operations began towards the end of 1911. On March 912, an area of nearly 3 acres was rented for ten years on the leased estate of Prince Eszterhazy. From that date, the necessary work for the preparation and irrigation of the soil has been in progress. In order to ensure a sufficient water supply eight reservoirs have been made into which pipes take the water direct from the ducal domain. A depot has been built by the Ministry of Agriculture to serve as a depot also a packing and tool shed.

The experiment field is divided into three lots, each containing 800 beds of strawberries. In order to propagate intensive and systematic strawberry cultivation, a course of three half-years (middle of March to middle of October) has been arranged; the programme of instruction is as follows:

Year I: Preparation and working of the soil, and planting; gathering and packing the fruit.

Year II: In addition to the above work, the artificial multiplication and selection of varieties which suit the climate; the preparation and irrigation of seed.

Year III: Especially the control of strawberry pests and the testing of various remedies.

The experiment field has been in full working order for nearly a year. The writer intends to carefully follow the different stages of the undertaking to make known the progress of the work, which is expected to prove satisfactory.

Varieties of Water-Cress. — LESOURD, F. in *Revue Horticole*, Year 85, No. 7, p. 164-165. Paris, April 1, 1913.

In industrial water-cress beds which supply large towns, the wild species (*Radicula Nasturtium-aquaticum*) is not grown, as it is not sufficiently productive. From seed and by selection, stronger, more productive varieties have been obtained, differing from the wild type in the luxuriance of the foliage and the form of their leaflets. The four following varieties are most remunerative: Billet cress (old variety), 7 leaflets; Boulanger, 7 leaflets; Chéron, 3 leaflets; Billet (new variety), 3 leaflets.

Capsicums. — FOUSSAT, J. in *Revue Horticole*, Year 85, No. 7, pp. 164-165. Paris, April 1, 1913.

The writer deals with the cultivation of capsicums in France, which is carried out either in frames, or else in the open in the South and in very sheltered spots.

In the North, the very hot-flavoured kinds are chiefly grown, e. g. the common, red capsicums used as condiments. In the South are grown the following varieties, which are much milder, and under various forms, cooked and raw, form a part of the daily food of the people. Large

Mild Square, Spanish Mild Square, Early Yellow Square, and American Mild Square.

681 - **The Summer Transplanting of Grafted Vines.** - LE JEUX, JEAN in *La Campagne*, Vol. XIII, No 157, pp. 210-212-fig. Paris, April 1, 1913.

The writer gives an account of a transplanting method adopted by Russian, M. Tutrumov in the case of grafted vines in Bessarabia. The latter was of opinion that vines could well be transplanted in July or August of the same year in which they were grafted. The grafts would then begin to grow in their new position in the autumn and continue in the following spring. In order to carry out the summer transplanting, M. Tutrumov had a sheet-iron cylinder made 13 inches high and 9 inches wide; a strengthening ring was fixed at the top and a handle attached to the cylinder, for a bucket; the cylinder is open at the bottom. This cylinder is driven into the soil round a vine, the soil being moistened and a narrow spade being used to help; when it is level with the surface, the enclosed soil and vine can be lifted by simply moving the cylinder from side to side a little and then drawing it out. These cylinders can be carried as they are if the soil is firm, but if it is loose a false bottom must be hooked on. For replanting, the cylinder is sunk in a hole and the soil pressed well round it; the earth inside is then watered and cut away from the walls with a knife, after which the cylinder can be drawn out.

M. Tutrumov finds this method always successful; the vines outstrip others of the same age, but not moved till the following spring, to such an extent that they might have been transplanted a full year earlier.

The writer remarks that, though this method may be too lengthy for planting on a large scale, it is well worth trying for gapping up; but the vines should be planted perfectly upright in the nurseries, as otherwise the roots would be cut off when the cylinder is forced into the ground.

682 - **The Koshû Vine.** - OMONO, J. in *Revue Horticole*, Year 85, No. 8, pp. 185-1 Paris, April 16, 1913.

Japan, on account of its excessively damp summers, is a very unsatisfactory country for vine cultivation; nevertheless some varieties of vine are grown there, one of which, called Koshû and belonging to the species *Vitis vinifera*, is much prized.

This vine is vigorous and has rather thick, fleshy roots which can resist phylloxera. There are two varieties: improved Koshû and Maru-Koshû (i. e. with round grapes). It resists chlorosis well, and is almost a climber as its stem is weak; the bark is thick. Buds simple or compound very large, wide at the base, but not very pointed; young leaves rather thick, with five shallow lobes, hairless and smooth on both surfaces; veins green, and teeth very acute.

In Tokio, this vine flowers early in June. The branches are ramified, the young herbaceous shoots are of a reddish green. The grapes colour at the end of August and are ripe early in October; the fruit is reddish white and the plant fairly prolific. The leaves are wide, not long, five-lobed, delicate, not very resistant to cold, distinctly toothed; the upper surface

of a fine green somewhat inclined to yellow, and fairly shining. The leaves turn colour late in the season and take a yellow tint.

Fruit. — There are two bunches on the shoot; the bunches are very large, the shoulders being long and well developed. The fruit is of good quality and in great demand for dessert; it is, however, also used for wine making.

- **A New Hybrid Direct Bearer.** — AUDRIOT, A. in *Journal d'Agriculture Pratique*, Year 77, Vol. I, No. 16, pp. 497-498. Paris, April 17, 1913.

The « Madone », a new vine from the department of Aude, has always been itself resistant to mildew, powdery mildew and rots. The parent vine, which is sixteen years old, has yielded grafts for the last six years.

This hybrid, like the Durief and Chasselas, is an early variety and is therefore suitable for planting in the vineyards of Eastern, Northern and Central France. It shoots late, blossoms soon and ripens early; further, suitable for growing on calcareous soil. Each shoot bears usually three bunches. As it is very vigorous and requires long pruning, it gives very good crops. If there is frost, the eyes and resting buds produce fruiting shoots with 2 to 4 bunches to the eye; and thus the crop is assured. The grapes which are shaded ripen as quickly as those exposed to the sun; this is an advantage in districts where the light is weak. The wine is bright in colour; its alcoholic strength is from 11 to 12 degrees. The flavour is pleasant and somewhat resembles that of the Hermitage wines.

This vine thus combines a number of qualities, which place it in the first rank of the direct bearers available for vine-growers who wish for an extensive crop.

- **Wines from Hybrid Vines at the Toulouse Exhibition.** — PÉRE-LABY, E. in *La Vie agricole et rurale*, Year 2, No. 19, pp. 543-547. Paris, April 12, 1913.

Already for some years, the Central Syndicate of Haute-Garonne, in co-operation with the various agricultural associations of the district, has organized an exhibition of wine made from hybrid vines. At these exhibitions, the samples presented are tasted, and as it is impossible to speak of the merits of a wine without discussing the qualities of the hybrid which produces it, a public meeting is held after the tasting, at which any person interested may give his opinion as to the cultural value of the hybrid.

The writer mentions the hybrids which have given the best results and records a perceptible improvement in the wines made from them; the results allow of their increased cultivation being predicted.

- **The Grafting and Exportation of Green Tunisian Table Olives.** — MARZAC, F. in *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation*, Year 16, No. 65, pp. 250-251. Tunis, Fourth Quarter, 1912.

In continuation of his previous investigations (1), which resulted in the discovery of a dozen varieties of olives suitable for preserving, the writer has directed his attention to finding out which of these were the best sorts for export. The Bidh variety alone possesses the necessary qualities for this

(1) See B. Nov. 1910, p. 86.

purpose. Barouni is a fine large fruit, but its flesh is coarse and its skin large, rough, and furrowed, the skin is thick, and the fruit not suitable for pickling. The other varieties are only suitable for local consumption. Bidh el Hamman is often as large as Barouni; its shape is similar to the Spanish Gordale, and its flesh is fine in texture and well-flavoured and contains a relatively small stone; this fruit fulfils all the requirements for export. The writer advises the use of this olive for grafting. Olive-growers will find it much superior to the varieties grown for oil making, both regards its yield and the high price fetched by the fruit.

686 - **Grafting Pears.** — PASSY, P. in *La Vie agricole et rurale*, Year 2, No. 1, pp. 474-475. Paris, March 29, 1913.

The stocks upon which the pear can be grafted are numerous, including seedling pear, quince, hawthorn, different species of *Sorbus*, and (in Algeria) Japanese Medlar or *Eriobotrya*. In France, only seedling pear and quince are commonly used.

For standard trees which are not to be pruned, but allowed to develop naturally, and will have to resist winds and the attacks of animals, the seedling pear must always be used as stock, no matter what kind of soil is to be planted. By this means, robust trees of large dimensions are obtained, capable of producing very heavy crops after a good many years. If on the contrary, small trees are desired, which are to be pruned regularly and the surplus crop annually suppressed, then the quince is the best stock to choose.

687 - **On the Cultivation of the Date Palm for Fruit in Sicily.** — BORZI, L. *Bollettino del R. Orto Botanico e Giardino Coloniale di Palermo*, Year XI, Part 1 (January-September), pp. 44-60. Palermo, 1913.

The cultivation of date palms with a view to obtaining eatable fruit can be successfully undertaken in Sicily, and especially in the southern portions of the island, under the following conditions:

1). Early ripening varieties must be introduced and grown. They require less heat for ripening their fruit than the inferior kinds, and therefore are more sure to become acclimatized. The common varieties, indeed, need a minimum of 5100° C., while 4080° C. are sufficient for the earlier kinds. It would therefore not be difficult to grow certain varieties in Sicily where the sum total of the temperature varies between 3650° C. and 3800° C. The same result can be obtained by cultivating very late varieties, which are capable of enduring low winter temperatures without the loss of the already-formed fruits. The latter would ripen at the end of the spring or during the summer of the following year. This method would also be the advantage of supplying dates before the African fruit was on the market.

2). Another plan would be to grow *Phoenix melanocarpa* Naud. care being taken to prevent the propagation of this species by seed. The fruit of this date palm is black and if not at once a favourite for table purposes, its excellence would soon ensure its sale, especially as it would appear on the market in the early summer. It is perhaps well to add that the

of date palm is well adapted to the milder climate of other Mediterranean districts.

3). It is necessary to try and obtain, by hybridization and selection, species or varieties which are capable of being thoroughly acclimatized in Sicily. For this purpose, advantage can be taken of the extraordinary capacity for variation possessed by the date-palm (hundreds of cultivated varieties being known), and of the facility with which crosses can be made between all species of the genus *Phoenix*. *Ph. canariensis* would be a good species for the creation of hybrids, since this tree extends beyond the arid zone of *Ph. dactylifera* and grows in latitudes where the temperature descends at times below 10° C. Further the fact that the Canary Date palm is capable of propagation when often only 8 or 10 years old, at least in the climate of Sicily, would greatly facilitate the solution of the problem.

8 - A Wind-break tested in Libya. — *Bollettino del R. Orto Botanico e Giardino Coloniale di Palermo*, Year XI, Part 1-2-3 (January-September), pp. 37-39. Palermo, 1912.

Myoporum serratum, which about thirty years ago was pointed out by Barzi as a suitable plant for arid and sandy soils and which was recently commended by Fiori for the fixation of dunes and by Bruttini (1) as a wind-break in Libya, has been successfully tested at Bucamez (Western Tripoli), where it thrives on sand infiltrated with brackish water, showing perfect resistance to the unfavourable conditions of climate and of soil. At present they are the only green plants existing on that shore.

9 - Forestry in China. — MONTAGUE, H. T. and WOODHEAD, H. G. W. *The China Year Book* 1913, *passim*. London.

Deforestation has played an active part on the surface of China, with the result that large forests in China proper are rare. They are met with, however, in certain districts of Central Asia, in S. E. Tibet and in Mongolia and Manchuria. In Eastern Turkestan are to be found birch, pine, fir, spruce, larch, and poplar, while in the less favoured districts Artemisia and tamarisks relieve the stretches of reeds and coarse grass that cover the steppes. In S. E. Tibet may be seen juniper, willow, pines, firs, cedars, elms and a large species of holly; while in the sheltered valleys grow wheat, barley, rice, fruit trees and vegetables. The medicinal rhubarb-tree is also a native of these plateaux. The tree grows to a height of eight or ten feet and the rhubarb of commerce is its root, dug up early in spring, cut into long flat pieces and dried. Dwarf elms and willows are met with in the Gobi Desert. In northern Mongolia and Manchuria the same trees reappear, together with oak and walnut.

Chinese timbers include pine, fir, maple, ebony, oak, camphor, teak, mahogany, birch, plane, elm. In this category may be mentioned the bamboo, which looms so largely in the everyday life of the Chinese. With it they build houses and erect temporary shelters: it is used for

(1) See No. 1429, B, Oct. 1912.

all scaffolding purposes, and for the transport of all goods by human agency. In early life it is used for food; when full grown it supplies the vast water population with masts, and from it are made chopsticks, pipe umbrellas, tables, stools and musical instruments. Between forty and sixty varieties of bamboo are said to be known to the Chinese.

Among other trees worthy of mention are the varnish tree (*Rhus vernicifera* D. C.), the tallow tree (*Shillingia sebifera* Michx.), wood-oil tree (*Aleurites cordata* Stend.), and vegetable wax tree (*Fraxinus chinensis* Roxb.).

Twelve species of rhododendron are met with in Szechuan, where the rhododendron forests are found at altitudes ranging from 2000 to 12 000 ft.

China has to import timber to satisfy its own needs, nearly as much wood entering China from abroad (£ 539 730 worth in 1911) as is obtained within its borders for purposes of local trade through the Customs (in 1910 £ 641 969). Foochow poles (fir and pine) are the chief feature of the industry. The forests are owned by private individuals, and timber is felled all the year round, while replanting is only done spasmodically. In this respect Fukien province resembles the rest of China. The main supply of timber has hitherto come from twenty-three districts in the prefectures of Yenping, Kienning, Shaowu, and Tungchow. The poles, using various streams, collect at Nantai, where in the aggregate they reach an annual value of £1 000 000. Hankow in 1910 for the first time surpassed Foochow as the chief port of the trade, with Antung, the port of export for Manchurian timber brought from the Yalu, and Kowloon next in order. The timber trade of Wuchow (Kuangsi), mainly in junk, is however estimated at £250 000. The output of the Yalu Timber Company for 1910 is given as 800 000 logs of 8 feet long. A dividend amounting to £150 000 was paid, equivalent to 5 per cent. on the original capital.

Examples of afforestation are being set by the Chinese in the Hongkong leased territory at Weihaiwei, in the German territory of Kiautschou, and by the Chinese Engineering and Mining Company at Tongshan, Chihli. Little attempt has been made by the Chinese to profit by these examples, but a writer in a recent *Bulletin* of the Royal Botanic Gardens, Kew, mentions that among the hill men or Hakkas of Kuangtung province the practice of forming plantations, mostly of pines, on the hills round their villages is becoming general; but they have not developed a sound principle of forestry and therefore obtain only a scant return for the labour expended upon it. It is indeed quite a rare thing to see any trees planted by the Chinese permitted to attain their proper development for market purposes.

The State Forest administration is attached to the Ministry of Agriculture and Forestry (Nung Ling Pu). The following official system was promulgated on August 8, 1912.

The Minister of Agriculture and Forestry has control over all matters regarding agriculture, irrigation, forestry, the breeding of

domestic animals, sericulture, pisciculture, reclamation of waste lands, and of all yamens established therefor, and officials connected therewith. The General Office of the Ministry, besides fulfilling the duties provided for under the General Rules common to all Ministries, shall undertake the following:

- a) All matters concerning Forestry and Agriculture.
- b) Agricultural and Forestry Exhibitions and Conferences.
- c) Investigations abroad in connexion with Agriculture and Forestry.

The Ministry shall contain the following Departments:

- a) General Agricultural Affairs.
- b) Reclamation.
- c) Forestry.
- d) Fisheries and Marine Products.

The Forestry Department shall supervise the following:

- a) Encouragement and supervision of afforestation.
- b) Conservation of forest.
- c) Government forests.
- d) Organization of forestry enterprises and control of same.
- f) Other matters relating to forestry.

1890 - A New Method for the Afforestation of the Sandy Portions of the Great Hungarian Plain (Alföld). — KISS, FERENCZ (Chief Counsellor of the Department of Water and Forests) in *Erdészeti Lapok*, Year LII, Part VII, pp. 296-318. Budapest, April 1, 1913.

The report presented on March 14, 1913, to the National Forestry Society and dealing with the afforestation of the sandy parts of the Great Hungarian Plain. This afforestation was intended at the beginning to protect the neighbouring pastures and cultivated land from the encroachment of the moving sands of the adjacent steppes. The work was begun 100 years ago, and its economic utility was only considered after the continued labours of a century had unexpectedly been crowned with success. At first, black poplars were planted, and it was only in 1870 that *Robinia* took exclusive possession of the wooded portions of the Alföld. The writer gives a biological study of the flora of the Great Hungarian Plain, including *Robinia*, which tree, in his opinion, is not capable of improving the poor soil. He recommends a new method, which does not confine itself to the afforestation of land suitable for tree plantations, but extends to the reclamation and improvement of a large portion consisting of sandy soil and sandhills, which hitherto has been little used owing to the poverty and dryness of the land. The writer attests the excellence of Austrian pine for preliminary planting, as it renders the soil suitable for the cultivation of more remunerative forest trees.

LIVE STOCK AND BREEDING.

691 - Oxidation of the Arsenite of Soda in Dipping Tanks. (1) - WILLIAMS, C.
The Agricultural Journal of the Union of South Africa, Vol. V, No 1, pp. 68-74. P
 toria, January 1913.

The writer mentions some facts observed by him in the laboratory the Central Experiment Farm, Cedara, Natal, namely that some samples of arsenical dip fluids after being kept in the laboratory for a short time often showed a distinct loss in arsenite. The amount of total arsenic in the fluid remained constant; there was consequently an oxidation of the arsenite with formation of arsenates.

The writer quotes an article by Messrs. W. F. Cooper and G. A. Freal in the *Journal of Agricultural Science* for October 1911, and the circular by Audrey V. Fuller, issued by the United States Department of Agriculture. In the latter the oxidation of the arsenite was attributed to the action of bacteria present in dip fluids under natural conditions. These bacteria possibly gained access to the tanks either through the water used in preparing the dip, or through the air or by the excrementitious or other matter derived from the live stock passing through the dip.

In the second half year of 1912 the writer conducted two series of experiments, in connection with the subject, in the laboratory at Cedara. Three dip fluids were prepared. The first was made up of sodium arsenite in pure water; the second contained excretory matter in addition, but otherwise was similar to the first; the third was made up according to Pichford's formula (arsenite of soda, paraffin and soft soap), with the addition of some excretory matter. Each dip was analysed immediately after it was prepared and also at the end of every month, for five months, the arsenite and the total arsenic being determined as arsenious oxide, As_2O_3 . The amount of total arsenic remained constant in each sample; while the arsenite did not undergo any oxidation whatever in the first dip, it diminished rapidly in the other two dips, practically disappearing within two or three months.

A second series of investigations was carried out with a proprietary arsenical dip, kept in the open in the tanks, and in the laboratory in closed vessels. The data thus obtained bear out Cooper and Freal's conclusions, that the oxidation of the arsenite is far more rapid in the summer months than in the winter, owing doubtless to the greater activity of the bacteria at the higher temperatures.

Referring to the fact that sodium arsenate is much less efficacious as an insecticide than the corresponding arsenite, the writer points out the importance of the question to stock owners, and considers it essential that

(1) See: No. 2198, *B.* July 1911; No. 2425, *B.* Aug.-Sept.-Oct. 1911; No. 146, *B.* 1912, Nos. 358 and 359, *B.* Feb. 1912; No. 810, *B.* May 1912; No. 934, *B.* June 1912 (Ed.)
 No. 43, *B.* Jan. 1913.

they should have the contents of their tanks analysed regularly in order to have estimated the amounts of both arsenites and arsenates in the fluid; or by the neglect of this precaution they would run great risks.

92 - **Destruction of the Pathogenic Agent of Foot-and-Mouth Disease: Experiments in Specially Constructed Manure Heaps.** — LOEFFLER, F. in *Berliner Tierärztliche Wochenschrift*, Year 29, No. 7, pp. 113-115. Berlin, February 13, 1913.

It has often been proved by experiment that temperatures of 60 to 70°C. (40 to 160° F.) may exist in manure heaps. As the agent of foot-and-mouth disease is killed by still lower temperatures, it may be concluded that manure from animals suffering from this disease is disinfected, if it is so kept that its temperature rises to 50 to 70° C. (120 to 160° F.) hitherto, however, this had not been proved.

In 1912, the writer prepared a manure heap in such a manner that its temperature was quickly attained. He introduced the pathogenic agent into the manure and a few days later used it for inoculation.

The experiment was carried out as follows. A layer of straw 10 inches thick was laid down upon a concrete surface 9 ft. by 8 ft. to serve as a base upon which to pile up the manure. The latter was a mixture of fresh cow and pig manure containing much straw. In the experiment, fresh lymph was used; it was mixed with a 0.9 per cent. solution of common salt in the proportion of 1 to 20, and filtered through Chamberland filters; 15 cc. of this mixture was put into test-tubes, and some tubes of lymph were kept in the cellar to serve as a control of the virulence. In addition, the hoofs of a pig which had died of foot-and-mouth disease, were cut off, wrapped in muslin, and introduced. The writer used 12 numbered maximum thermometers for the measurement of the temperature. The thermometers, hoof-parings and lymph-tubes were equally distributed in the heap while it was being built up. Another thermometer was put between the layer of straw and the manure. The heap was built up like a mangel-clamp and pressed down with forks; it was then covered with a layer of straw 4 inches thick, upon which was thrown a layer of dry earth of the same depth; the total height of the heap was 6 feet. After ten days, the manure was again spread and the thermometers, lymph and hoofs removed. The different thermometers registered from 55.5 to 75° C. (132 to 167° F.).

Pigs were then inoculated with the lymph and also with the hoof-extract, but they did not fall ill; but when inoculated with the control lymph they sickened. Thus the pathogenic agent must have been destroyed by the heat of the manure heap. It is therefore possible to make the manure from animals suffering from foot-and-mouth disease entirely free from infection, if the heap is constructed and managed in the manner described by the writer.

93 - **The Internal Application of Carbolic Acid for the Prevention of Contagious Abortion in Cattle. The Relation of Granular Vaginitis to Abortion.** — TAYLOR, W. J. in *Bulletin of the Montana Agricultural College Experiment Station*, No. 90, pp. 19-31. Bowman, Montana, July 1912.

The experiments commenced in 1909 in three herds seem to warrant the following conclusions:

- 1). Carbolic acid, either fed in solution or injected hypodermically, seems to be a specific against contagious abortion.
- 2). Cows, as a rule, will eat with apparent relish as much as 750 cc of a 4 per cent. solution of carbolic acid in feed daily.
- 3). The hypodermic injection as a treatment in an affected heifer involves less labour than feeding.
- 4). In cases of impending abortion, carbolic acid can be injected in sufficient quantity to cause staggering gait and dilation of the pupil of the eye (when it should be withheld for from ten to fifteen hours and repeated) with no apparent unsatisfactory after-effects.
- 5). All males used for breeding purposes should be treated with carbolic acid either hypodermically or in the feed. The penis and sheath should be thoroughly disinfected, both before and after service. Contagious abortion and granular vaginitis may be transmitted through the medium of the male, unless proper precautions are observed.
- 6). Not all cows showing granular vaginitis abort.
- 7). Heifers pregnant for the first time are more liable to abort than during subsequent periods of gestation and should be carefully watched and vigorously treated, if abortion exists in the herd.

694 - **Plants Poisonous to Live Stock in Paraguay and in Misiones (Argentina)**
 BERTONI, MOISÉS S. in *Agronomía, Boletín de la Estación Agronómica de Puerto Berto-*
ni, Vol. V, No. 3-4, pp. 140-144. Puerto Bertoni, Paraguay, January-February 1911.

The writer agrees with Spegazzini that the toxicity of poisonous plant is generally due more to the stage of their growth than to their specific character. Besides, the quantity eaten by the animals, the age of the plants, and the conditions of climate and soil affect the degree of toxicity. There is no doubt that pastures with very young grasses are the most dangerous; it is well known that many herbaceous plants in their early stages contain hydrocyanic acid. In other plants this acid may be formed in the parts that are cut and kept for a few hours.

In Misiones there are several plants in the pastures which are poisonous when they are very young. Such are — according to the writer's observations — the Gramineae *Cynodon dactylon*, *Andropogon halepensis*, *A. co-*
densatus («aguarrá-ruguái» or «cola de zarro»), *A. bicornis* («ca-
San Juan»), *Panicum sanguinale* («kaapii-ahñhi» or «falsa cebadilla
de Misiones»). There are, however, some exceptions: castor oil plant
are harmless when young and become poisonous when adult; the species
of *Tragia* *and of* *Dalechampia* *are harmless when young, but they are*
be regarded with suspicion when grown up.

It is also known that drought and the compactness of the soil increase the toxicity of certain plants; in other plants, on the contrary, the writer has observed that they become more poisonous after abundant rain. Such is the case with some of the above-mentioned Gramineae, and perhaps manioc.

* Among the poisonous or dangerous plants, the writer mentions further *Commelina sulcata*, a species of *Tradescantia* (called «trapuerava» in Brazil).

Bromelia fastuosa, *Tragia volubilis* («ihshpó-pihnd»), *Manihot Tweedieana* («guazú-matidío»), some Euphorbiaceae, *Polygonum acre* («aá-tás»), *Brunfelsia Hopeana* («jazmin del Paraguay» or «azucena», but rarely eaten by animals), *Solanum sisymbriifolium* («revienta caballos» or «putui»), *Ternstroemia Hilariana* and *T. australis*, *Spatocarpa sagittifolia* (which is avoided by live stock), *Equisetum giganteum* (which contains aconitic acid, or a nearly allied substance). The writer adds that this list is certainly still incomplete.

95 - Investigations into the Micro-Flora of the Large Intestine of Cow and Sheep. — CHOUKEVITSCH, JEAN in *Annales de l'Institut Pasteur*, Year 27, Vol. 27, No. 3, pp. 246-263. Paris, March 25, 1913.

The writer investigated the colon and caecum of five cows and five sheep, and found that the micro-flora in the organs of these two kinds of animals was not very dissimilar. The bacteria present in the large intestine of the cow are chiefly cocci and rod-bacilli; coli-bacteria always occur in large numbers; strepto-cocci, often in the degeneration stage and encysted, are present in largest numbers in the caecum, or in the upper part of the colon. Towards the rectum, the signs of degeneration become increasingly clear. The short-rods, which often occur in reduced numbers, form no spores within the intestine; they measure 0.3 μ by 4 to 6 μ . The micro-flora of the colon of the cow differs from that of the horse (previously studied by the writer) in that the rare bacteria are more numerous in the former; also the bacteria in the cow's intestine seem to preserve their morphological characters better. To determine the species, the most varied cultures were made and the writer succeeded in isolating, in addition to those already mentioned, the following species.

I. Agents of putrefaction: *Bacillus proteus vulgaris*, *B. Welchii*, *B. putrificus*, *B. sporogenes* A, *B. sporogenes* B, *B. sporogenes foetidus*, *B. sporogenes* vus.

II. Proteolytic bacteria (not including agents of putrefaction): *Bacillus endobacteriensis*, *B. hastiformis*, *B. flavescens liquefians*, *B. amylolyticus*, *B. mesentericus*, *B. megatherium*, *B. pyocyaneus*, *B. mycoides*, *Chlostridium steolyticum*. In *B. mesentericus* the ruber-form was found more commonly in the *vulgatus* form.

III. Bacteria decomposing cellulose, hemicellulose and starch: *Bacillus xogenes*, *Bacterium Rodella III*, *Bacillus amylobacter (butyricus)*, *B. amylois*, *B. Welchii*, *B. mesentericus*, *B. Ellenbachensis*, *B. amylolyticus*, *B. mycoides*. The formation of gas in the colon is attributed to the Rodella I group.

IV. Bacteria of acid media: *Bacterium Merejkowsky I*, *B. Moro*, *Streptococcus anaerobius magnus*, *Bacterium roscens*, *Bacillus megalosporus*, *B. tenuis*; occasionally a coccus resembling *Micrococcus candicans* was isolated.

Of these bacteria, some always occur in the intestine, forming the constant micro-flora of this organ: *Bacterium coli*, cocci, *Bacterium Moro*, *Bacterium Merejkowsky I*, *Bacillus Welchii (perfringens)*, *B. putrificus*, *B. sporogenes* A,

B. hastiformis, *B. flavescens*, *B. gazogenes*, *B. Ellenbachensis*, *B. mesentericus*, *Bacterium Rodella III*, and those decomposing cellulose. *Bacillus amyli* *tenuis* is probably also constantly present.

In sheep, the micro-flora is richer in species; streptococci are more numerous and usually more degenerated. In addition to those mentioned as found in the intestine of the cow, the following were isolated: *Bacillus tenuis non-liquefaciens*, *B. irregularis*, *B. ramiformans*, *Sarcina flava*, *Vibrio terrigenes Güntheri*, *Actinomyces albus*, *Bacillus hervolulus Zimmermani*. The following always occur in the colon: *Bacterium coli* cocci, *Bacterium Moro*, *B. Merejkowsky I*, *Bacillus Welchii*, *B. putrificus*, *B. sporogenes A*, *B. sporogenes B*, *B. mesentericus*, *B. Ellenbachensis*, *B. hastiformis*, *B. flavescens*, *B. gazogenes*, *B. amyli tenuis*, *Bacterium Rodella III* cellulose-decomposing bacteria.

As the writer found a similar flora in horse, cow and sheep, and always bacteria which decompose cellulose, hemicellulose and starch, he considers that the composition of the flora depends less upon the species of animal than upon the kind of food consumed by the latter. In a later work the little-known species will be described.

696 - **Fluctuations in the Body Temperature before Parturition in Cow, Sheep and Goat.** — LINDER in *Deutsche Landwirtschaftliche Tierärzt, Year 17, No. 1*, pp. 149-150. Hannover, March 28, 1913.

The results of the examination of the body temperature at the end of the last period of gestation in the case of 50 Black-spotted Lowland cows and of sheep and goats were as follows: The temperature rises during advance gestation and sinks again before parturition; the fall begins in the case of the cow at 11 ½ to 56 hours before calving and in that of the sheep a week before lambing. In goats, a second decrease in temperature occurs one day previous to parturition.

697 - **The Pepsin and Chymosin Question.** — RAKOCZY, A. in *Hoppe-Seyler's Zeitschrift für Physiologische Chemie*, Vol. 84, Part 5, pp. 329-353. Strassburg, 1913.

Experiments on the coagulation and digestion of milk in the stomachs of various mammals, according to which young ruminants, foals and pigs secrete, as well as pepsin, an independent ferment (chymosin) which coagulates milk. Opossums only produce pepsin, and the milk is coagulated by the action of this ferment. As neither pepsin nor chymosin is found in the stomachs of dogs and cats, the causes of milk coagulation in their stomachs are unknown.

698 - **Report of the Zoometrical Studies made in 1912 at the Shows at Pau, Rouen and Poitiers.** — VOITELLIER in *Bulletin Mensuel de l'Office de Renseignements Agricoles*, Year 12, No. 1, pp. 46-63. Paris, January 1913.

The measurement data and the live weight estimations made on specimens of most of the French breeds of cattle, of three breeds of sheep (Charolais, Oxford Down, Dishley-Merino), and of one breed of donkeys (Pau). The height at the withers was taken as a basis for the measurement.

599 - **The Fertility of Hybrids in a Mammalian Species-Cross.** — DETLEFSEN, J. in *American Breeder's Magazine*, Vol. III, No. 4, pp. 261-265. Washington, October, November, December 1912.

Sterility is a common phenomenon in the hybrids obtained by mating members of distantly related groups or types, in both animals and plants. In case both sexes are sterile, a further genetic study becomes impossible. When one sex alone among the hybrids is sterile, that sex is usually the male; and since the females are fertile, it becomes possible to study their inheritance of characters and fertility of offspring by crossing them back to the males of either parent species.

Among mammals, at least, work on inheritance and fertility in species crosses is in its inception. The consensus of opinion is that the cross between horse and ass results in sterile male mules, but that the female mule is occasionally fertile with either the horse or ass (Waldow von Wahl, 1907). The zebroid (zebra \times horse) is supposed to be sterile in both sexes (Ewart 899; Ivanoff 1911); the same is true of the zebrale (zebra \times ass). When the cow and bison are crossed, they produce fertile female catteloes, but sterile males (Bond, 1908; Ivanoff, 1911). These female hybrids were crossed back to males of both parent stocks: the one-quarter bison females are fertile; the three-quarters were not fully tested, but are possibly also fertile. The one-quarter bison males are not always fertile, but Ivanoff reports a fertile three-quarters bison male.

The writer worked out the progeny of a cross between the wild Brazilian cavy (*Cavia rufescens*) and the domesticated guinea-pig (*Cavia porcellus*). The two forms differ consistently and clearly in colour, texture of hair, size, shape of skulls and skull sutures, tooth formation, etc. The original crosses between the two species were the result of mating the wild males to the tame females, but matings were secured with much difficulty. The reciprocal cross was not attempted, as it was feared that the smaller wild female would succumb in pregnancy when mated to the much larger tame males. The tame females bore their hybrid young in due time and with the usual guinea-pig average per litter, thus proving that the wild males were wholly fertile.

Having obtained these half-wild hybrids, the females were mated back to the wild males and the tame guinea-pig males, producing three-quarters and one-quarter wild respectively. The matings to the wild males were not very successful, and only one three-quarters wild male was reared to maturity. The latter proved sterile. The matings to the tame males were wholly successful and produced 83 one-quarter wild. The hybrid females of one generation back were mated to tame guinea-pig males and over 1700 hybrids of various blood dilutions were produced, ranging from $\frac{1}{4}$ wild to $\frac{1}{32}$ wild.

The problems to be resolved were as follows: how great must be the blood dilution, or for how many generations must the hybrid females be crossed back to the guinea-pig, to eventually produce fertile male hybrids? When fertile male hybrids are produced, would their offspring

be fertile in both sexes, if such males were mated to their hybrid sister or guinea-pig females?

The breeding test being hardly sufficient to decide an animal's fertility the writer devised a new test. He obtained a complete index of the male fertility by making a small incision in the scrotum, puncturing the epididymis at one or two points and examining the liquid contents with the aid of a microscope. There was a great difference between individual hybrids; some males might not possess any sperm at all, but in their place were found a few, or many, incompletely matured spermatogonia; others possessed a few non-motile or motile spermatozoa in addition. Still others might have an abundance of motile spermatozoa, just as any normal male. All grades and combinations were found; but the last class alone could be successfully mated to females. The fertility of the hybrid males is shown by the following table:

| Class of hybrids | Total number tested | Per cent. with any sperm | Per cent. with any motile sperm | Per cent. readily fertile |
|------------------------------|---------------------|--------------------------|---------------------------------|---------------------------|
| $\frac{1}{2}$ wild | 6 | 0 | 0 | 0 |
| $\frac{1}{4}$ " | 22 | 25.0 | 0 | 0 |
| $\frac{1}{8}$ " | 71 | 47.8 | 17.3 | 9.8 |
| $\frac{1}{16}$ " | 94 | 71.1 | 46.6 | 35.5 |
| $\frac{1}{32}$ " | 89 | 88.7 | 62.9 | 60.7 |
| $\frac{1}{64}$ " | 21 | 100.0 | 66.7 | 66.7 |

After a careful examination of the mobility of the spermatozoa, the writer considers that every male which has an abundance of motile spermatozoa is undoubtedly fertile. Such fertile males are especially numerous in hybrids with least wild blood, as is shown by the table.

The male hybrids derived from crosses between a fertile male hybrid and a female hybrid, gave all grades between absolute sterility and fertility but when a fertile male hybrid was mated to a guinea-pig female, all the male offspring were fertile.

The guinea-pig colour, coat, size and anatomical characters were transferred to the hybrids. Any combination of these characters may be united with fertility. It is conceivable that desired characters in hybrids between other mammalian species (including cattaloes and mule

100 - **Mendellism and Interspecific Hybrids.** — COOK, O. T. in *The American Naturalist*, Vol. XLVII, No. 556, pp. 239-245. Lancaster-Garrison-New York, April 1913a
A criticism of Dr. Nabour's treatise on crossing *Bos indicus* with *Bos taurus*, which appeared in No. 547 of the above-mentioned periodical (1).

101 - **The Exportation of German Stud Stock, especially to the Colonies.** — NEUMANN in *Deutsche Landwirtschaftliche Presse*, Year 40, pp. 311-313. Berlin, March 29, 1913.

The writer estimates from the official statistics that in 1909, 7128 horses were exported from Germany, of which 5123 were horses or the knacker, 929 draught horses, 798 carriage, riding and race horses, 9 ponies, 97 stallions and 82 foals. The horses for slaughter and those used for purposes other than breeding, were chiefly sent to Switzerland, while the stallions went to the Netherlands and the foals to Austria-Hungary. German stud horses were also imported by Belgium, Denmark, France, Russia, Sweden, Switzerland, the United States (28 stallions), Brazil, German South-West Africa (8). Many animals of the Holstein, Oldenburg, Hanoverian and East Prussian breeds were exported.

In 1909, 10 455 head of cattle were exported, of which 36 per cent. were bullocks for the butcher. Most of the butcher's beasts were sent to Switzerland, the stud cattle going to Austria-Hungary, Russia (255), German South-West Africa (73), Kamerun (7), Chile (12), Brazil (5), and the United States (3). The Black-spotted Lowland cattle are in much request abroad, specially in Russia and Austria-Hungary. Red-spotted Holsteins, and specially Angles, are prized in the Russian Baltic Provinces. In addition were exported cattle of the Grey-Brown Mountain, Höhen Spotted (to Russia, Argentina, China), Frankish, Red Central German, Pinzgau and Alpgäu breeds.

Of the 53 889 sheep exported the same year, most of those destined for exportation were sent to Switzerland. German stud sheep went to Russia, Austria-Hungary, France, Denmark, Serbia, British South Africa, German South-West Africa, Australia, Brazil, Uruguay and Chile.

The number of goats and pigs exported was negligible.

The exportation of cattle to German East Africa, German South-West Africa and Kamerun is attended by the following restrictions which came into force on January 8, 1913.

- 1) Cattle may only be exported from districts which are declared free from foot-and-mouth disease, and from herds in which there has been no case of this disease for eight months.
- 2) The vendor is required to produce official proofs of the fulfilment of these conditions.
- 3) Animals may only be exported from Hamburg, and before embarkation must remain for 14 days under observation at the inspection station established by the German Agricultural Society in that city. (2).

(1) See No. 1318, B. Sept. 1912, for a notice of this article.

(2) Founded in 1909.

4) On arrival in the Colonies, the cattle are subjected to 28 days quarantine.

702 - **Small Breeders' Associations in Italy.** — VEZZANI, VITTORINO. — *Publication del Comitato Nazionale per la Mutualità agraria*, pp. 156. Rome, 1913.

Breeding Syndicates have arisen during the last thirty years and have spread throughout Europe. They are especially numerous in Austria, Belgium, Denmark, Germany, Norway, Holland, Sweden and Switzerland while they are in course of formation in France, Italy and Russia; Japan has already a good number.

According to recent statistics of the ministry of Agriculture, Italy now possesses 133 Associations of this description, of which the greater number have come into existence during the last seven years.

In Italy, the most suitable legal form for Breeding Societies is that of the ordinary Civil Association in the case of syndicates without share capital, and of the Cooperative Society in that of syndicates with share capital.

The Horse Breeding Syndicates, which have been established in Italy under the name of "Consorzi Stallonieri", use most of their share-capital for the purchase and maintenance of a selected stallion to serve the mare belonging to the members.

The Cattle Breeding Associations are of greater importance to Italian agriculture, on account of the great development of the cattle-breeding industry. The Breeding Syndicates have assumed different forms, ranging from the most simple to the most complex. There are so far, with one exception, no societies for the improvement of sheep, goats and pigs, nor any small poultry associations.

No Federations of Breeding Syndicates yet exist in Italy.

703 - **List of Stud Book Associations.** — *Illinois Stallion Registration Board, Bulletin*, No. 3, pp. XVII + 234. November 1, 1912.

This bulletin contains a list of all the American and Foreign Stud Book Associations authorized by law, which are the only associations that the Illinois Stallion Registration Board is permitted to recognize (see Section of Law regulating the Public Service of Stallions in Illinois, amended June 5, 1911). A directory of the licensed stallions on November 1, 1912, is given, with their number, breed, date of foaling and the names and addresses of their owners. There are now 9677 stallion licences in force; of this number 5688 are for pure-bred horses, 3984 for grades and 5 for cross bred.

704 - **The Annual Live Stock Show at Santiago, Chile, in 1912.** — *La Exposición Animal de Animales.* — *Boletín de la Sociedad Nacional de Agricultura*, Vol. XII, No. 11, pp. 689-713. Santiago, November 15, 1912.

An account of the annual live stock show organized by the National Agricultural Society (Sociedad Nacional de Agricultura), which was opened on October 16, 1912.

There were 570 head of horses and cattle exhibited, as well as poultry. A complete list is given of the prizes awarded, and the article contains photographs of some of the animals.

95 - **The Shire Horse Show.** — *Live Stock Journal*, Vol. LXXVII, No. 2030, pp. 210-215. London, February 28, 1913.

In February 1913 the thirty-fourth annual show of the Shire Horse society was held. The prize money and breeders awards amounted to 2230 and the number of horses entered was 685. The article gives a detailed description of the various sections and the list of prize winners.

96 - **London Hackney Show.** — *Live Stock Journal*, Vol. LXXVII, No. 2031, pp. 239-246. London, March 7, 1913.

The twenty-ninth annual show of the Hackney Horse Society was opened at the Royal Agricultural Hall, Islington, on March 4, 1913, and was continued until the evening of March 7. The entry was some 572, against 11 last year. The prize money amounted to £1844. This article describes the exhibits in the 43 classes, and gives a list of awards made up to the evening of March 6.

97 - **Thoroughbred and Hunter Show.** — *Live Stock Journal*, Vol. LXXVII, No. 2032, pp. 270-274. London, March 14, 1913.

The twenty-ninth annual London Show of the Hunters' Improvement and the National Light Horse Breeding Society was opened on March 11. The number of horses entered was 306, and £9850 were offered in Premiums, Super Premiums and prize money.

The article describes the various classes of Thoroughbreds and Hunters, and gives the list of the prize winners.

98 - **Report of the Eighth Systematic Show of Milch Cows of the Brown Breed on September 28, 1912, at Crema, Italy.** — *Pubblicazione della Cat'edra ambulante d'agricoltura e del Comizio agrario di Crema*, pp. 34. Crema, 1913.

An illustrated brochure with a preface written by Dr. Z. Camertoni explaining the aim, organization and importance of the Crema show, and giving the reports of the judges of the fourteen sections (the system of having one judge being maintained) as well as the complete list of the prizes awarded.

99 - **The Italian Artillery Horse.** — PROCCHI, ANTONIO in *Giornale d'Ippologia*, Year 26, No. 7-8, pp. 3-7. Pisa, April 1, 1913.

The question of the breeding of artillery horses is one of great importance for Italy.

After considering the nature of the work required of these horses, the writer gives a list of the qualities necessary for them. From the point of view of build, the artillery horse, especially the wheel-horse, which has the heaviest work, should be thick-set, with very short legs, solidly built; straight, short and broad in the body, and supported by strong legs, with straight action. According to the excellent description given by Captain Ajroldi the wheel-horse comes at the limit of the category of fast heavy horses, belonging to the lightest of these, or at the limit of light horses, being the heaviest of these.

Its weight should be considerable, and varies from 1100 lbs. to 1200 lbs..

The height at the withers should be equal to the length taken from the point of the shoulder to the end of the rump. In general, the height at

the withers should vary from a minimum of 15 hands to a maximum of 16 hands, while the optimum is between 15.2 and 15.3. The transverse development of the body should be great, and the girth should exceed the height by one-eighth.

Blood is a very important asset in the case of the off wheel-horse, and is indispensable to the near mounted horse. The more rapid the work the more breeding is required; but this should never be excessive, as what is most necessary is the maximum equilibrium between the working of the nervous system and that of the organs of locomotion. Artillery horses should be quiet and stand cannon fire well. They must trot more or less fast according to the type of artillery for which they are intended. Further, they must be able to stand great fatigue, and under the worst possible conditions; in fact they must above all be very strong and possess much staying power, which latter can be developed by systematic exercise.

Without dwelling upon the very complicated question as to the best manner of increasing the production of artillery horses in Italy, the writer devotes a few words to certain fundamental points whose observance is necessary for the solution of the problem.

These may be summarized as follows:

- 1) It is necessary to study thoroughly the horses of the different districts of Italy, in order to be able to form horse-breeding zones and to determine the course to be followed in each of these for the purpose of rearing horses for the army.
- 2) By means of propaganda, horse shows and competitions, and so-called traction races, etc., it is well to make the breeders acquainted with the qualities necessary for the artillery horse and the rules to be followed in breeding and rearing it.
- 3) The breeders should be assured of obtaining a remunerative price for their horses; this might be effected by raising the prices and giving special prizes, so that the profit to be gained may act as an incentive to the production of the horses which are needed.

710 - **Marsh Ponies of the United States.** — CURTIS, R. S. Marsh Ponies of the Eastern Coast. — *The Breeder's Gazette*, Vol. LXIII, No 4, pp. 191-192. Chicago January 22, 1913.

The Marsh Ponies of the eastern coast of the United States probably owe their origin to the numerous groups of small horses which have lived for some centuries in a half-wild state on the narrow banks of land adjacent to the shores of Virginia, the Carolinas and to some extent further south along the coast of Georgia and of Florida.

The soil of these banks and islands is very sandy and often marshy and the vegetation growing upon it so poor as to seem to preclude the persistence of a breed of horses even of this diminutive size.

The banks of the greatest importance in the production of these ponies are found to the east and north of Pamlico Sound, and more especially those islands or banks just east of Carteret county (North Carolina).

The writer has made some researches on the origin of these half-wild horses and after mentioning the opinions of several authors, he concludes by affirming the possibility that marsh ponies are the descendants of horses imported by the first settlers, it appears towards the end of the sixteenth century.

The ponies, which graze in full liberty on the islands of the coast, belong to several owners who brand all their animals. Every year during May, June, July and August the whole drove from each of the banks is rounded up in pens and the colts following their mothers are caught and a brand is put on them corresponding to that of the mother. In this way each owner is enabled to recognize his stock at future pennings. All yearlings which are found without brands are turned over to the drivers to be disposed of; thus all discussion is avoided.

The ponies sell on the banks at \$50 (£10) to \$75 (£15), and even more for the better ones. The younger ones fetch from \$25 (£5) to \$35 (£7) each.

After the penning the ponies which have not been disposed of are allowed to return to their accustomed haunts, where they gather during the breeding season, each stallion with a band of mares. In the foaling season the mares select a secluded spot, where they remain until after their maternal duties are over.

The stock of the low lands runs 10 to 12 hands in height, while in some favoured conditions the size may be considerably larger. Their colour varies greatly. Some are bay with some inclination to shade into a mouse colour, others blood bays, dark brown, cream, sorrel and mouse colour, etc.

The ponies are very hardy and serviceable for light work. When first taken from their home they are somewhat shy and when they come in the early season they are covered with a long thick mossy hair. With proper grooming and feeding this can soon be removed and the coat becomes sleek and glossy. When properly cared for they possess considerable beauty. They have very shapely heads, fairly clearly-cut lines and clean legs. The feet are rather tough and small. They make very serviceable saddle ponies and light drivers. On the coast they are used to broad-tired carts by the farmers and fishermen.

According to reliable statements, about 150 ponies are raised each year in Carteret county. From Beauport inlet to Portsmouth near Ocracoke inlet, it is estimated that there are 1100 ponies on the beach.

No particular attention seems to be paid in the Carolinas to the improvement of these animals, the owners being satisfied with the present efficient remuneration.

1 - *The Poitou Mares of France*. — ASHTON, J. in *The Breeder's Gazette*, Vol. LXII, No. 11, pp. 663. Chicago, March 12, 1913.

A short account of the mule-breeding industry and a description of the Mulassière breed of mares used, of which there are about 25 000 in the old province of Poitou. The annual production of mules is about 12 000 head. The writer also gives data respecting mule rearing and feeding.

the trade in these animals (which are mostly exported) and the average prices they fetch. Small mules are sold at from \$200 to \$220; larger animals at \$240 to \$290, and a few even reach \$360.

712 - The Inheritance of the Property of Milk Production and the Utilization of the Results Obtained by the Control Society. — PETERS, J. in *Deutsche Landwirtschaftliche Tierzucht*, Year 17, No. 11, pp. 121-125; No. 12, pp. 133-135; No. 13, pp. 145-149. Hannover, March 1913.

The writer has investigated the inheritance of milk production in a registered herd of Dutch cows in East Prussia. The milk yield and pedigree of the animals has been registered since 1884. As the milk yield of a herd during 28 years (1884-1912) can be much affected by external circumstances the average production of the herd for each year of this period was estimated; it amounted to 7799 lbs. in 1884 and 9957 in 1912. The milk yield of the herd was especially high in 1896 and 1907. In order to determine the cause of this increased production, the writer, in the first place, ascertained the influence in this direction exerted by the bulls which were most often used as sires. The following were determined: 1) average milk yield in particular years of all the daughters of each bull; 2) how this yield compared with the milk production of the other cows of the herd during the same year; 3) the average milk yield of the dams of cows sired by these bulls; 4) how the average yield of the daughters compares with that of the mothers.

On the basis of these investigations, the writer concludes that the increased yield during the period 1896-1906 is chiefly due to an improvement in the average quality of the herd, while the further average increase of 1907 to 1912 is primarily attributable to the better feeding and tending of the animals.

After the writer had investigated the development of the milk yielding property of the herd, and ascertained the quality of each single cow as a milk producer, he divided the cows into classes and investigated how the milk yield of the offspring compared with that of the mothers. The data which are arranged in tables, show that there are great variations in the inheritance of the property of milk production. The offspring of the best mothers yielded, on an average, the most milk and those of the inferior mothers the least. The range of variation was, however, not so great among the daughters as among the mothers. First class cows produced both good and inferior offspring, and the opposite is true. The inheritance varied around a centre, which was somewhat higher in the daughters of superior mothers than in those of inferior cows. The magnitude of the variation was the same for all the classes. (1).

Peters then determined the milk production of the grandparents and of the separate families of the herd. With regard to the families he found that some produced relatively many good animals, while the others

(1) Cf. also "Cow Testing in the Breeding of Dairy Cattle", No. 1550, B. Nov. 1911 (Ed.), especially pp. 2476-2480.

The writer comes to the conclusion that it is not sufficient to estimate the absolute and relative yield of the cows, and upon these data to select the offspring of the *best individual* performers for further breeding, but it is necessary to select the *best families*, for amongst the descendants of these will be found the largest number of good milch cows.

Abstract from the Report of the work of the Malmöhus Control Association for 1911-1912 and those in Denmark for 1910-1911. A summary and comparison of the results of the last 8 or 10 years.

These experiments were made by the writer in 1912 at the Proskau University Institute for the purpose of determining in what measure the American hominy (a by-product of maize) could be used as a substitute for rye.

| | Lot I | Lot II |
|--|-------------------|--------------------|
| | lbs. | lbs. |
| Initial weight of all the pigs | 118 $\frac{1}{4}$ | 122 $\frac{1}{2}$ |
| " | 569 $\frac{1}{4}$ | 589 $\frac{1}{2}$ |
| Gain in weight " | 451 | 467 |
| " in 1 month | 109 $\frac{1}{2}$ | 122 $\frac{1}{4}$ |
| " 2 months | 177 | 167 $\frac{1}{4}$ |
| " 3 months | 164 $\frac{1}{2}$ | 177 $\frac{1}{2}$ |
| Amount of food required to produce an increase of 1 lb. in live-weight. | 2.1 | 2.06 |
| | \$ s d | \$ s d |
| t of food { skimmed milk. | 2 3 3 | 2 3 3 |
| { barley | 3 3 3 | 1 5 4 |
| { hominy. | — — — | 1 14 0 |
| Total cost of feeding. | 5 6 6 | 5 2 6 |
| Cost per pound increase of live weight. | 2.3 d | 2.2 d ^o |

Fourteen six-weeks-old pigs of the improved German breed were selected and divided into two lots, each containing 4 hogs and 3 sows. All the animals were given skimmed milk, crushed barley and a little powdered chalk (about $\frac{1}{4}$ oz. per head per day). At the commencement of the experiment half of the barley was replaced by hominy for group II. As the pigs became older, the rations were increased in proportion to the gain in live-weight, and in lot II more of the barley was replaced by hominy; towards the end of the experiment they got nearly twice as much hominy as barley. The feed was given moist four times a day.

The experiment lasted from June 12 to September 3, and no bad effects were observed, but the pigs did not seem very keen on their food.

The animals were weighed singly and fasting at the beginning of each week and at the commencement and close of the experiment; the average of these results was taken. These data are given in the table on p. 931.

Although the experiment with hominy was satisfactory, the writer does not consider it advisable to replace barley by larger quantities of hominy, and still less to substitute the latter entirely for the former, as the appetite of the animals would be affected by the change.

715 - **Fattening of Pigs with the Automatic Feeder (1).** — DE LA BARRE Aufzucht und Mästung von 4 sechs Wochen alten Ferkeln am Futterautomaten. — *Tierärztliche Nachrichten der Landwirtschaftskammer für die Provinz Brandenburg und Mittheilungen der Versuchsanstalt für landwirtschaftliche Fütterungsversuche zu Korbädt (Westpreußen)* Year 6, No. 2, pp. 15-17, Prenzlau, February 16, 1913.

Two sow pigs and two hogs were fed by means of the dry-feeding automatic apparatus from their fortieth day until they were fattened. At the beginning of the experiment, the dry food consisted of 2 parts crushed barley, 1 part wheat meal and $\frac{1}{2}$ part fish meal freed from fat. Each pig received also daily for the first week about a quart of whole milk and $2\frac{1}{2}$ quart of skimmed milk mixed with a little sifted crushed barley and fish meal, and for the following 10 days $3\frac{1}{2}$ quarts of separated milk. This first ration was intended as a preparation for pure dry feeding. Subsequently the following substances were put into the automatic apparatus in addition to those above mentioned: "Fattinger's Körner blutfutter II", crushed beans, ground maize, ground rye and potato flakes.

From the beginning of the fourth week up to the end of the experiment, the dry food was made as shown on the opposite page.

In addition to the dry feed the pigs also received comfrey (*Symphyla asperum*), cabbage and beet leaves, garden refuse, and sliced mangel. To encourage digestion, a small quantity of Teichel's digestive salt "Pankubus" was mixed with the food.

The pigs developed normally. One of them was sold to the butcher at the age of 22 weeks, while the other three were fat when they were 2

(1) See the diagram and description of an automatic feeding apparatus in No. 31 below; references given there. (Ed.)

| Week | Crushed barley | Wheat meal | Potato flakes | Körner- blut- futter II. | Fish meal | Crushed maize | Crushed rye | Crushed beans |
|----------|-------------------|---------------|------------------|--------------------------------|--------------|------------------|----------------|------------------|
| I. . . . | 7 | 5 | 1 | 0.6 | 0.6 | — | — | 0.2 |
| III. . . | 5 | 5 | 1 | 0.5 | 0.5 | 0.3 | 0.3 | — |
| IV. . . | 5 | 5 | 2 | 0.5 | 0.5 | 3 | 3 | — |
| VIII. . | 10 | 10 | 5 | 1 | 1 | 10 | 6 | — |

peaks and 3 days old. The results of the experiment may be summarized as follows:

Weight of pigs at beginning of experiment . . . 84.7 lbs.
 " " " " end " " . . . 839.3 "
 Increase in weight 754.6 "

Average increase in weight per head, per day:

when 6-12 weeks old 16 $\frac{3}{4}$ oz.
 " 12-16 " " 22 $\frac{1}{4}$ "
 " 16-20 " " 26 "
 " 20-22 " " 26 $\frac{1}{2}$ "
 " 22-26 $\frac{1}{2}$ " " 24 $\frac{1}{2}$ "

£ s d
 Total cost* of feeding 10 14 10
 Cost of food per 100 lbs. live weight 1 8 5

* Garden refuse and mangels, which were eaten in small quantities only, are not included.

- An Experiment in Pig Feeding and Fattening on Sugar Cake (Brand B.) (1). MANICARDI, C. in *L'industria lattiera e zootecnica*, Year 11, No. 6, pp. 86-87. Reggio Emilia, March 15, 1913.

This experiment was made on 40 pigs, divided into two lots of 20 each; of which one was given farinaceous food as is customary in the district, while the other was fed sugar cakes (Brand B), supplied by the Italian Distilleries Milan. The two lots also received whey and bran.

The pigs ate the cake with avidity, and when the animals were slaughtered, the flesh presented its usual appearance, while the fattening results were superior to those obtained with farinaceous food; further, the sugar cake proved to be the more economical feed.

(1) This cake is composed of: grape pomace meal, dried distillation residues and dregs. For experiments in feeding milch cows with this product, See No. 1551, B. P. 1912. (Ed.)

717 - **Fattening Hogs in Nebraska** (1) - SNYDER, W. P. and BURNETT, E. A. *Idin of the Agricultural Experiment Station of Nebraska*, Vol. XXIV, Article II (No. 1), pp. 71. Lincoln, Nebraska, June 15, 1912.

The results of previous experiments are summarized and full details are given of the recent experiments.

The bulletin is divided into two parts; the first deals with the use of alfalfa hay with corn for fattening hogs; the second is devoted to a comparison of corn, corn and alfalfa, with supplementary foods for fattening hogs.

The conclusions are the same as those published in the preceding bulletin, No. 123.

718 - **A Comparison between Natural and Artificial Incubation.** - BRECHEMIN, in *Giornale degli Allevatori*, Year IX, No. 3, pp. 21-24. Catania, February 15, 1911.

In describing the results of some comparative experiments in natural and artificial incubation, the writer first states that no comparison can be made in the period from December to the end of February, because it is then very difficult to find broody hens. Turkey hens can indeed be obtained, but their use entails great inconvenience, for as their time of incubation is longer than that of fowls, they crush some of the chickens the first day of hatching unless these are removed on the nineteenth day, when after having been placed for some minutes in tepid water, they can be hatched in an incubator.

The experiments were made during March, April and May. Three turkey hens and three fowls were used on the one hand, 100 eggs being entrusted to them, while the parallel experiment was carried out in an incubator with a warm water tank, the heat being maintained by means of a small lamp.

This incubator was provided with a regulator; the egg chamber was deep and the bottom was concave and covered with wire gauze. A hundred eggs were placed in the incubator every month.

After incubation, the eggs were examined by being held up to the light and the clear and infertile ones removed. The incubation results were as follows:

Natural incubation: 242 fertile eggs produced 158 chicks

Artificial incubation: 243 fertile eggs produced 209 chicks

Thus the results were entirely in favour of artificial incubation. In order to prove this fact thoroughly, a comparison was instituted between natural and artificial rearing.

The food was the same in the case of all the chickens; it consisted for the first three days of a mash of hard-boiled eggs, and subsequently of soaked bread, boiled potatoes, boiled rice, maize cake and meat meal for the mash, with crushed millet, oats, and buck wheat. The chickens entrusted to the hens and turkeys were kept in open houses and allowed the run of a grass park of about a quarter of an acre in extent. The artificially reared chickens were kept on a space only two-thirds of the size and housed at

(1) See No. 1658, B. Dec. 1912.

large shed glazed in front. The brooder was of very simple construction, with a zinc plate and petroleum lamp and was provided with a small adjoining run enclosed with wire-netting and glazed.

Three months after hatching the results were as follows. Out of 158 chicks reared naturally, 75 were alive, while 194 of the 209 artificially-reared birds had survived. The loss, which exceeded 50 per cent. in the case of naturally reared chickens, (being larger with turkey foster-mothers than with hens), was only 10 per cent in that of the artificially reared chickens.

The loss is however, much less if the fowls are kept in coops or in closed houses.

In conclusion, the writer states that, though natural incubation and pairing are perhaps to be recommended for small poultry breeders, and for raising breeding birds, the resulting chickens being more robust, artificial methods are preferable in the case of large poultry farms.

- **Experimental Work in Artificial Incubation.** — BROWN, W. in *The Journal of the Board of Agriculture*, Vol. XIX, No. 11, pp. 909-914. London, February 1913.

The writer mentions the fact that the results obtained by artificial incubation are not equal to those obtained by natural means. He gives, in his connection, an account of experiments which R. J. Terry, poultry expert to the Tasmanian Government, has been carrying out for the past years. Mr. Terry suggests that eggs receive too much air in modern incubators, and draws attention to the fact that the irregular broken ring blood, which sometimes occurs before the sixth day instead of the "spiral" seen with a living embryo, is more common in eggs from incubators which have excess of ventilation than in others. Fewer chickens are reared in well-ventilated incubators.

- **The Württemberg Apicultural Stations for the Production of Selected Queen Bees.** — *Die Bienenpflege*, Year XXXV, No 4, pp. 73-77. Weinsberg, April 1913.

A report of the work of the Stations for the production of selected queen bees of the German breed.

- **Automatic Fishing Apparatus.** — *Bollettino della Società lombarda per la pesca e l'acquicoltura*, Year VI, No. 3, pp. 37-40. Milan, March 1, 1913.

This article deals with a new system of fishing effected by an apparatus devised by Cav. Giuseppe Pino and already patented.

The automatic fisher consists of a framework of pieces of wood fastened together by means of coupling boxes in a form suitable for making the bottom of the apparatus. Upon this are fixed 16 very strong poles, which are kept vertical to the framework by means of three stays to each pole by wire ropes. At the summit of these poles are affixed 9 bags of netting corresponding to the 9 squares formed by the framework. These bags, which are 22 feet deep, are in the shape of a funnel and have a wooden sliding valve at the bottom, dividing the bag into a larger and smaller part, the latter serves to catch the fish and is capable of being emptied by, or oftener during the day.

In the centre of the framework, below the central bag, is situated a receptacle for the compressed air, which causes the ascent and descent

of the apparatus, and is kept in place by 16 metal cords affixed to the framework. The mechanism which works the apparatus consists of a motor feeder, and a compressor of sufficient power, used to pump the air into the accumulator. The latter, which has an india-rubber tube fitted with a tap, is attached to the raising receptacle of the apparatus.

The apparatus descends on closing the tap which admits the air, and on opening the one which allows the air to escape. The special arrangement for the vertical descent and oblique ascent of the apparatus consists of small wooden regulators placed on the principal base framework.

The apparatus can be constructed on a small or large scale, and fishing can be done at great or small depths. For fishing with this apparatus, a motor boat of about 10 H. P. is necessary; part of this force is used for compressing the air. In order to raise the automatic fisher, when once it has descended to the bottom, it suffices to subject the air in the receptacle for ascending to a pressure exceeding that of the water at this depth. The apparatus while ascending, can be dragged by the boat (by means of the rope by which it is attached to the latter) in such a way that it can assume at will a vertical or oblique position.

The fisher is so balanced that, in spite of its weight of about 10 ton and its surface of 1100 sq. yds. it floats perfectly, raising the bags of the net above the water and allowing the boats to pass between these to see whether any fish have been caught, and remove the spoils, if the nets are full.

The apparatus was successfully tested in the Lake of Zurich and the inventor is making a second of 840 sq. yds. in size, with only four bags, which he intends trying in the Mediterranean.

The cost of the automatic fisher is about £320 and together with the motor boat, the whole price would amount to £800.

722 - **Actinomycosis of Prussian Carp.** — PLEHN, MARIANNE in *Allgemeine Fische Zeitung*, Year 38, No. 9, pp. 222-224. Munich, May 1, 1913.

The writer describes in the text, and with the help of illustrations, a new chronic fish disease, actinomycosis, due to a fungus. The latter attacks Prussian carp (*Carassius Carassius*), producing abscesses in the kidneys or other internal organs. The external symptoms of the disease are the sluggish movements and the swelling of the body of the fish.

723 - **The Effect of X-Rays upon the Development of the Ovary of the Rabbit** — REGAUD and LACASSAGNE in *Comptes Rendus Hebdomadaires des Séances de Société de Biologie*, Vol. 74, No. 11, pp. 601-604. Paris, March 21, 1913.

The writers tried the effect of the X-rays upon several rabbits' ovaries and found, upon examining the latter some hours later, that the follicle cells had been injured. The stronger the X-rays used, the more the follicle cells were harmed. A fortnight after the ovaries had been exposed to the rays, all the follicles, with the exception of some small primordial cells invisible to the naked eye, had disappeared. With the disappearance of the follicles, the activity and formation of the interstitial glands of the follicle capsules decreased. About 3 months after the X-ray treatment the writers observed a new formation of the glands on the surface of

vary, but they were much less active than before. The follicle cells which remained unharmed gradually grew to normal and abnormal Graafian follicles within 6 months. The former gave rise to ova, which were capable of fertilization and produced normal offspring. The writer observed no fresh formation of ova, nor any reappearance of follicles which had disappeared on exposure to the X-rays.

FARM ENGINEERING.

1 - **New Cultivator.** — *Wiener Landwirtschaftliche Zeitung*, Year 63, No. 26, p. 310. Vienna, March 29, 1913.

This new cultivator consists of a three-wheeled carriage, supporting an adjustable frame containing tines similar to those carried by extirpators. The depth of the tines can be adjusted up to 7 $\frac{1}{4}$ inches. Behind these tines there are four adjustable disks intended to break up the soil loosened by the tines. If these disks are not suitable to some kinds of soil they can be replaced by a toothed harrow. As this implement works a strip 16 ft wide at a time, and can be quickly drawn by the smallest steam ploughing engine, the amount of work it can do is very considerable. It is especially adapted for paring a field after the harvest and for loosening and preparing for sowing fields that have been deeply ploughed before the winter, that have borne potatoes or beets.

5 - **Trials of Mechanical Ploughing Tackle at Sétif and Maison-Carrée (Algeria).** MARMU, M. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year 112, First Half-year, No. 1, Vol. 119, pp. 147-157. Paris, January 1913.

These trials lasted from May 26 to June 12, 1912, and were held partly at Sétif and partly at Maison-Carrée. The following five machines were not to be tested.

The C. I. M. A. tractor (Titan).

The Avery tractor.

Landwin's agricultural motor.

The tractor of the Case Co. (a French firm).

J. and H. Macdaren's tractor.

The article contains tables giving the dimensions and characteristics of machines, as well as the amount of force required for the work done, time required, the depth and width of the ploughing and the amount of fuel used.

These trials did not give the expected results, for the nature of the soil to be ploughed had not been taken into account in the construction of the machines. The commission are of opinion that tractors with explosion motors should not be introduced into North Africa until the taxes on motor spirit and fuel are reduced.

- 726 - **The Use of Mechanical Power in Agriculture** (1). — SCHWANECKE, H. K. in *Fühings Landwirtschaftliche Zeitung*, Year 62, Parts 7 and 8, pp. 242-272 and 286-306. Stuttgart, April 1 and 15, 1913.

After some preliminary remarks on the most important power-driven agricultural machines, the writer compares the various systems of mechanical ploughing from the points of view which have the greatest interest for farmers, such as cost of installation, weight of the principal parts, performance, number of hands and team required, saving of teams and of working expenses, utilisation of the motor for other objects.

In the second part of the paper he treats of transport machines and especially of field railways and motor waggons.

- 727 - **Electricity and Agriculture**. — KOPPEL, R. in *Monatshefte für Landwirtschaft*, Year VI, Part 4, pp. 97-110. Vienna, April 1913.

The writer gives a very instructive review of the present state of the application of electricity to agriculture. After introductory remarks on the cost of electric motor power and on the approximate amount of power required by the most commonly used agricultural machines (threshing machines, electric milkers, cereal cleaners, scutching and shearing machines), he discusses electric incubators and brooders.

The writer then considers tilling by electricity and its economy, and gives an example of the total cost of such an installation.

After a brief mention of recent experiments on radio-activity, the paper concludes with remarks on the production of electricity.

- 728 - **Agricultural Machines at the Machine Exhibition in Paris in 1913**. — COUPAN, G. in *La Vie Agricole et Rurale*, Year 2, No. 18, pp. 485-493. Paris April 5, 1913.

The writer gives a detailed description and diagrams of some of the machines for working the ground, which are distinguished by innovation and improvements. He mentions Massignon's subsoil plough, Bajac's drain plough, Letroteurs' balance plough and also Bajac's balance plough. Machines for mechanical ploughing are also described, such as the steam ploughing engine of the "Société Française de matériel agricole et industriel", the Avery, Fowler and Doizy tractors, the Stock motor plough and others.

- 729 - **Motor Power Cultivation with only one Winding Drum**. — RINGELMAN, M. in *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year III, 1st Half-Year, Vol. 119, No. 2, pp. 352-357. Paris, February 1913.

The writer describes and illustrates the machines of E. Kuntz and A. Bajac which were exhibited at machine shows in Paris and explains their working.

- 730 - **The Mesmay Tractor**. — DE CONDÉ, F. in *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year III, First Half-year, Vol. 119, No. 2, pp. 330-35. Paris, February 1913.

A description, with figures, of the Mesmay tractor, together with an account of its performance at the Bourges trials.

(1) See No. 400, B. April 1913.

II - New Patents for Agricultural Machines and Implements.

- 53 969,454 (Austria). Motor plough.
- 58 976,454 (Austria). Motor plough, in which the revolving driving pawl moves in a fixed guide.
- 59 532, 45 a (Austria). Outfit for double engine system of ploughing.
- 59 539, 45 a (Austria). Motor plough with vertically adjustable steering wheel, provided with a coupler flange, running on the unploughed land.
- 59 537, 45 a (Austria). Apparatus for tilling the soil, with revolving disks mounted obliquely on a shaft.
- 59 538, 45 a (Austria). Turn-wrest plough.
- 59 331,2 a (Switzerland). Automatic device for turning and fixing the working parts of multiple ploughs.
- 450 965 (France). Fore-carriage for ploughs, on two or three wheels, with the beam below the axle of the side wheels.
- 451 372 (France). Implements for motor ploughs.
- 259 163, 45 a (Germany). Apparatus running on rails, especially turn-wrest plough for market gardens.
- 259 165, 45 a (Germany). Subsoil loosener for ploughs.
- 259 083, 45 a (Germany). Hoing outfit for tilling machines, with hoes fastened by means of intermediate parts to separate disks.
- 259 085, 45 a (Germany). Apparatus for tilling the soil with several implements mounted on a revolving axle and working successively.
- 259 260, 45 a (Germany). Motor plough with driving wheel running in the furrow behind the plough shares.
- 2057 (England). Self-propelled tractor.
- 16 160 (England). Power-driven tillage machine.
- 4930 (England). Motor plough.
- 1 056 532 (United States). Plough lift for gang ploughs.
- 1 056 531 (United States). Plough lift for gang ploughs.
- 58 970, 45 a (Austria). Spring-tooth cultivator, with teeth working in the wheel ruts.
- 59 587, 2 a (Switzerland). Cylinder for field and pasture rollers.
- 59 332, 2 a (Switzerland). Ribbed roller clod-crusher.
- 1056 514 (United States). Rotary harrow.
- 450 871 (France). Apparatus for cleaning rotary harrows.
- 451 393 (France). Spring tine cultivator.
- 58 975, 45 a (Austria). Manure coverer for ploughs, which by a swinging movement removes the manure from the coulter and share-point.
- 59 269,45 a (Austria). Manure distributor for machine dibbles.
- 59 271,45 a (Austria). Manure distributor.
- 1056 577 (United States). Guano distributor.
- 59 273,45 a (Austria). Potato planter.
- 259 261, 45 b (Germany). Multiple-furrow potato-planter, with chain of cups under hopper.
- 1598 (England). Drill for turnip and other seeds.
- 58 967, 45 b (Austria). Grass mower with reaping attachment.
- 58 973, 45 b (Austria). Machine for binding straw, hay, etc.
- 59 400, 45 b (Austria). Apparatus for lowering the sheaves, in reapers.
- 59 792,2 c (Switzerland). Cutting apparatus for mowers and reapers.
- 451 537 (France). Reaper.
- 2854 (England). Mowing machine.
- 1056 122 (United States). Mower attachment.
- 259 386,45 c (Germany). Mower with vertically adjustable finger disk and horizontally revolving knives and carrier arms.

59 412, 45 b (Austria). Potato lifter, hay tender or swath turner with throw wheel, the tee of which are driven by planet gearing with centre wheel mounted on elastic supports.

59 474, 43 b (Austria). Potato lifter with apparatus for depositing crop.

59 558, 2 a (Switzerland). Drum hay tedder with excentric gearing for the line shaft

451 673 (France). Hay rake.

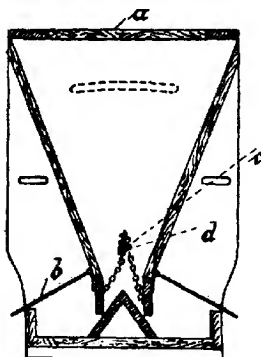
1 056 665 (United States). Grain harvester.

59 266, 45 b (Austria). Apparatus for cleaning seeds and the like, with endless screw placed over each other.

59 535, 45 b (Austria). Straw elevator.

732 - Helm's Automatic Feeder (1). — *Illustrierte Landwirtschaftliche Zeitung*, Year 3: No. 33, p. 218. Berlin, March 19, 1913.

With the apparatus shown in the annexed figure there is no danger that the pigs can soil their food. The feeding troughs are closed on both side by iron covers (b) which have to be raised by the pigs when they take the



food; (a) is a moveable cover; (c) the adjusting lever, and (d) the shaft with chains for moving the boards. This automatic feeder is refilled every five days with the required amount of food.

733 - An Apparatus for Drying Cotton. — *The Agricultural News*, Vol. XI, No. 2; p. 403. Barbados, December 21, 1912.

The accompanying photographs (1) show a new apparatus for cotton drying, which differs in its system from those hitherto used for the purpose in St. Vincent by its simplicity and the ease by which drying operations can be effected even during wet weather. The system was devised by Mr. C. C. Hazell, of St. Vincent and comprises a drying rack on wheels. The cars can be moved easily; their length is 13 ft., their width 3 ft. 7 in., and their height 8 ft. 4 in. They hold seven trays each 5 inches deep running the whole

(1) For experiments in feeding with automatic distributors see No. 1606, B. Dec 1912; No. 283, B. March 1913; and No. 713 above. (Ed.)

(1) These were kindly placed at our disposal by Mr. W. N. Sands. (Ed.)

length and width of the car; the bottoms of the tray are made of $\frac{1}{4}$ inch galvanized wire netting, so that the air passes easily through the cotton. As the cars run on rails both inside and outside of the drying house, moving them requires little labour. When the cars are inside the house, the cotton is protected from the weather by the device of covering the outside end of each leading car with galvanized iron sheeting, which exactly fits the slit space in the wall when the car is pushed home.

Fig. 1. shows the car when drawn out, while fig. 2 gives the whole apparatus.

RURAL ECONOMICS.

734 - **The Installation and Accounts of a Large English Dairy Farm.** — The Production of Clean Milk on Two Large Dairy Farms. — *The Journal of the Board of Agriculture*, Vol. 19, No. 11, pp. 923-928. London, February, 1913.

The Kelmscott herd of pure-bred dairy Short-horns is said to be the largest in the country, and the system on which it is kept is admirable. The owners farm an area of 2144 acres in contiguous holdings in Oxfordshire, Gloucestershire and Wiltshire. Over 200 cows are kept, and the milk is sent daily to London. In 1909, all cows and heifers in milk were tested for tuberculosis, and since that year the stock has been tested annually. So far only eight animals have reacted and six of these were stock not bred at Kelmscott. No cow that reacts is allowed to contribute to the milk supply. In order to ensure the purity of the milk great care is taken that the hands and clothes of the milkers should be scrupulously clean. During most of the year, the cows are groomed before milking and the udders washed. The tails, udders and hind quarters are kept clipped; and the cowhouses are clean and well-ventilated.

The milk is not pasteurized, but simply cooled to 38° F. Although many milking machines are in use on the surrounding farms, they have not been adopted at Kelmscott, where all the milking is done by hand.

The wages are relatively high; Messrs. Hobbs pay a day labourer from Oct. 1 to Sept. 30, 15s 4d without cottage) the average weekly wages of an Oxfordshire labourer are 13s, or with harvest money, cottage (if provided), extras, etc., 16s 4d; an under-carter's wages at Kelmscott are 17s 0 $\frac{1}{2}$ d, including lodging at 1s per week, a head-shepherd's 26s 2d reckoning 1s 6d a week for cottage and garden. The men's cottages are of an exceptionally good class; the total number of the staff is 102.

The rations fed to the cows vary greatly according to the value of the different feeding stuffs but the following tables indicate average feed :

Winter.

- 3 lbs. dried grains,
- 3 lbs. mixed bean meal and oat meal,
- 3 lbs. cotton, soya bean and dairy cake mixed.
- 9 lbs. per day for thirty weeks.

Summer.

- 2 lbs. cotton cake,
- 1 lbs. soya bean cake,
- 1 lbs. dairy cake,
- 4 lbs. per day so long as the animal gives 2 gals. daily.

The average milk yield per cow for the three years ending September 30, 1911, was for 134 cows 6015 lbs., this being the lowest average for many years owing to the summer drought. The average yield per cow for 191 was 6330 lbs, and for 1909, 6500 lbs. The average yield of an average farm cow in Great Britain is perhaps 4500 lbs.

The average yearly expenditure of recent years has been £13.09 6s 10d. Messrs. Hobbs have made the following estimate of the cost of a herd of 40 dairy cows kept on their system.

Estimated Cost of Herd of 40 Dairy Cows.

| <i>Food.</i> | <i>£</i> | <i>s</i> | <i>d</i> |
|---|-------------------|----------|----------|
| Grazing, $1\frac{1}{4}$ acres per cow = 50 acres at 30s | 75 | 0 | 0 |
| Rates at 2/6 in £ | 9 | 7 | 6 |
| After feed, $1\frac{1}{4}$ acres per cow = 50 acres at 6s. | 15 | 0 | 0 |
| $1\frac{1}{4}$ tons hay = 50 tons at 40s | 100 | 0 | 0 |
| 56 lbs. mangolds per day per cow for 210 days = $5\frac{1}{4}$ tons | | | |
| $\times 40 = 210$ tons at 5s | 52 | 10 | 0 |
| 6d per cow per day feeding stuffs, 210 days £5 5s 0d | | | |
| $2\frac{1}{2}$ " " " 90 " £0 18s 9d | | | |
| | £6 | 3s | 9d |
| | $\times 40 = 247$ | | |
| | | 10 | 0 |

Attendance.

| | | | | |
|--|-----|----|----|----|
| Thirty weeks, winter | 99 | 0 | 0 | |
| Fourteen weeks, summer | 29 | 8 | 0 | |
| Milk cart, horse and driver. | 40 | 0 | 0 | |
| Depreciation in value of cow per year, £ 1 | 40 | 0 | 0 | |
| Losses in death, abortion and veterinary expenses. | 40 | 0 | 0 | |
| Expense of bull 5s per cow | 10 | 0 | 0 | |
| Up keep of dairy utensils 5s | 10 | 0 | 0 | |
| Total £ | 767 | 15 | 6 | |
| Per cow £ | 19 | 3 | 10 | |
| Produce per cow: 600 gall. milk at 8 d | 20 | 0 | 0 | |
| Value of calf | 2 | 10 | 0 | |
| | £ | 22 | 10 | 0 |
| | £ | 19 | 3 | 10 |
| Balance (gross profit) £ | 3 | 6 | 2 | |
| To Railway Company: carriage of milk, 600 gallons at 1d per gallon | 2 | 10 | 0 | |
| Net profit per cow | 0 | 16 | 2 | |

15 - "The Evesham Custom."— *The Gardener's Chronicle*, Vol. LIII, No. 1367, pp. 156-157. London, March 8, 1913.

More than 10 000 acres of land in the neighbourhood of Evesham are occupied by market gardens, which are, with few exceptions, leased to tenants. The great extension and the flourishing condition of this intensive cultivation are due, in addition to other circumstances, to the system of tenure obtaining in that district. This system, entitled the Evesham custom, allows the tenant to pass his lease on to a third party, on payment of a sum as compensation for improvements to the ground and the expenses incurred in planting; the new tenant, with the consent of the owner, takes over the land on the same conditions as the former tenant.

The tenant is thus able to give up, at any season of the year, and whenever he wishes, the whole, or a portion, of his land to another tenant and incurs no risk by so doing.

He is also empowered to hand over part of the market garden to his grown-up sons, as soon as they are capable of managing the business.

Owing to the short period of time which elapses between the giving of the notice to quit and the incoming of the new tenant, it is impossible for the old tenant to exhaust the land and thus decrease its value. Further, even if he had a longer time at his disposal, it would be to his own interest to keep the market garden in the best possible condition, for the compensation which he receives at the close of his tenancy is based upon the condition of the land at that time.

The owner of the land is thus relieved of the necessity of compensating the outgoing tenant for improvements or planting; and is saved the cost and frequent litigation entailed by the often difficult matter of valuation. This system also greatly diminishes the risk of not finding a new tenant within a given time.

The writer gives a brief summary of the provisions of the "Market Gardeners' Compensation Acts".

6 - **Reorganization of Agricultural Land Tenure in Russia.** — HITTER, H. *Progress de l'Agriculture russe. — Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year 112, No. 1, pp. 133-146. Paris, January 1913.

The Imperial Decree of February 19, 1861, had given the rural population as perpetual holding 294 150 000 acres of land; of this quantity 12 875 000 acres was the property of the communes, and 51 275 000 acres consisted of family hereditary holdings. In no case were the grants of land made to individual farmers, but always to the commune, which had then to distribute the land among the various families.

In this distribution the land was classified according to its quality and to its distance from the village, and from each class a plot was given to each villager to cultivate. At every new redistribution of the land rendered necessary by the growth of population, the number of classes was increased; this naturally gave rise to an ever increasing subdivision of the land with all its attendant evils.

On March 30, 1905, the Czar of Russia appointed a special commission the object of discussing and proposing measures intended to convert

the collective property of the communes into private property of the peasants. An Imperial Decree of November 3, 1905 exonerated the peasants from the payment of arrears after January 1, 1907, for the purchase of land.

The same decree authorised the Peasant's Bank founded in 1882 to advance peasants up to 90 per cent. of the value of their properties at an amortization interest of $4\frac{1}{2}$ per cent. for $55\frac{1}{2}$ years. In August 1906 this Bank was entrusted with the task of selling about 5 000 000 acres of crown lands to the peasants. A further decree of October 5, 1908, permitted peasants to possess land in different communes. Lastly the law of June 14, 1911 recognized the right of every peasant to become proprietor of his share of the communal property, and every commune obtained the right of converting the whole of its property into private properties.

In order to carry out in practice the new organization of landed property, the Central Committee for Agricultural Organisation was instituted, to train the necessary local authorities and to guide them in their work. The local authorities were appointed by Decree of March 4, 1906 under the name of Agricultural Commissions, in the various governments and districts. They were composed of Government officials and of representatives of the *Zemstvos*, the nobility and the peasantry. At present upwards of 6000 persons are working on the commissions in 47 governments. The surveyors engaged in the division of lands number 2730, with 2722 assistant surveyors. Between 1907 and 1911, 90690 communes sent in to the agricultural commission their request for the reorganization of the conditions of land tenure, and the surveys of 29 080 000 acres in 30431 communes have been made.

In the reorganisation of the landed property a distinction has to be made between the individual and the collective agricultural reorganisation. The former deals with the total abolition of collective ownership and its transformation into private property, uniting the several plots belonging to one owner. The latter proposes only to diminish somewhat the evils arising from a minute subdivision of collective property by creating new hamlets on outlying lands and by dividing the communes consisting of several villages into several independent communes. Since 1907 the number of small independent landowners has increased by 654 550. For the reorganisation of collective properties, which is only a transitory step towards the creation of private property, the plans referring to 7 450 314 acres of land have been approved by the inhabitants of the communes concerned.

Since 1906 the agricultural commissions have rented out 12 229 271 acres of State lands as small farms, and sold 887 851 acres to 57 293 peasants. The Peasant's Bank has bought, through the agency of the Commission, 13 981 544 acres of land from the large landowners with the object of selling them again as small farms. In order to facilitate the purchase of such farms by the peasants, the State grants them loans up to 150 rubles ($\$15\ 17s\ 6d$), repayable in 10 years without interest, and subsidies up to 100 rubles ($\$10\ 11s\ 8d$). Up to January 1, 1912, the Commission had granted

the peasantry 147 670 such loans, amounting to £1 423 659, and 32 100 subsidies amounting to £91 498.

737 - **Loss of Area due to Setting out Roads and Ditches in the Rearrangement of Properties.** — KESSLER in *Landwirtschaftliche Zeitschrift für die Rheinprovinz*, Year 14, No. 16, pp. 284-286; No. 17, pp. 297-299; No. 18, pp. 315-316. Bonn, April and May 1913.

After a short review of the origin of the parcelling of fields and of the consequent servitude called in Germany "Flurzwang" (1) on the object and importance of the rearrangement of fields and the creation of a new network of roads, the writer combats the opinion that through the making of new roads and ditches too much land would be lost for agricultural purposes. He calculates, on the basis of the plans for the rearrangement of properties in the districts of Trefenbach, Kraftsolms, Ebersgöns and Hörnsheim, the amount of land which the setting out of new roads and ditches would take from the land at present utilized.

In this calculation he assumes that the injury caused by the excessive division of the fields is equivalent to the loss of a strip 18 inches wide for every plot of arable land and to one 10 inches wide for every plot of meadow; this loss is caused by the boundary furrow not being utilized, by the lower yield of the boundaries owing to imperfect manuring and to stagnation of water, and by the area occupied by the temporary roads. Considering the advantages of the new plans (Establishment of boundary stones, straight boundary furrows, careful and uniform manuring and tilling, abolition of temporary roads), the breadth of the boundary furrow of the new arable fields and of the meadows is reduced by 2 inches.

The plots of large proprietors or of associations, which, on account of their various sizes, would interfere with the formation of a just average, have been omitted from the calculation. The writer, however, includes in the area required for the drainage and smaller irrigation ditches, notwithstanding the fact that the value of these areas is abundantly recouped by the adjoining meadow plots owing to the improvement due to the making of the ditches (See table).

The table shows that the area required for the new roads and ditches almost exclusively supplied by the unutilized old boundaries. The three districts of Tiefenbach, Kraftsolms and Ebersgöns are situated in a very uneven region, and require a close network of roads that occupy a good deal of space, while Hörnsheim lies on flat land; consequently results are more favourable here than in the other districts.

Naturally the result is always much influenced by the greater or less subdivision of the fields, or in other words by the greater or less extent of rearrangement that has to be done. In view of further subdivision among heirs, the larger plans were divided in this rearrangement into smaller ones not exceeding an average of half an acre in extent; and as a basis

(1) "Flurzwang" is that servitude which, owing to the division of properties, obliges all owners to cultivate the same crops as their neighbours.

| | | Wefenbach |
|---|---|---|
| Number of plots before the rearrangement | | 7246 |
| Total area of these plots | | 994.4 acres |
| Area occupied by the old roads and ditches | | 39 acres |
| Area occupied by the new roads and ditches | | 105.3 acres |
| Excess of area required by the new roads and ditches | | 66.2 acres |
| Above excess in percentage of total area | | 7.3 % |
| Number and area of plots belonging to large proprietors, associations, etc. | | 646—794.7 acres |
| Area occupied by roads and ditches in above plots | | 14.3 acres |
| Area remaining for the other plots | | 51.9 acres |
| Number and area of old cultivated plots, not including above plots . . | | 4930—555.1 acres |
| Average area of plots | | 0.114 acre |
| Average length | | 295.2 ft. |
| Average breadth | | 16.4 ft. |
| Number and area of old meadow plots not including above plots . . | | 2170—143.3 acres |
| Average area of plots | | 0.067 acre |
| Average length | | 131.2 ft. |
| Average breadth | | 22.0 ft. |
| Utilized area | arable land meadow land total | $(295.2 \text{ ft.} + 16.4 \text{ ft.}) \times 177$ $4930 = 52.1 \text{ acres}$ $(131.2 \text{ ft.} + 22 \text{ ft.}) \times 95$ $2170 = 6.2 \text{ acres}$ $52.1 + 6.2 = 58.3 \text{ acres}$ |
| Number of new arable plots | | 1080 |
| Average length of new arable plots (1) | | 360.8 ft. |
| Number of new meadow plots | | 370 |
| Average length of new meadow plots (1) | | 328 ft. |
| Utilized area | arable land meadow land total | $360.8 \text{ ft.} \times 15.7 \text{ in.} \times 1080 = 11$ $328 \text{ ft.} \times 7.9 \text{ in.} \times 370 = 11$ $11.86 + 1.83 = 13.69 \text{ acres}$ |
| If the old utilized area there remains thus for roads and ditches . . | | 44.6 acres |
| Excess still required | | 7.3 acres |
| Percentage of area subject to contribution | | 1.05 % |

(e) In the new plots there is no boundary strip left against the roads.

| Krafschips | Ebergsdons | Hörnshelm |
|---|---|---|
| 7800 | 7100 | 6856 |
| 985.3 acres | 897 acres | 1205 acres |
| 36.8 acres | 32.1 acres | 33.4 acres |
| 85.5 acres | 88.9 acres | 89.7 acres |
| 70.9 acres | 56.3 acres | 56.3 acres |
| 7.2 % | 6.34 % | 4.7 % |
| 1050—267.4 acres | 260—168 acres | 806—103.8 acres |
| 19.3 acres | 10.6 acres | 4.94 acres |
| 51.7 acres | 46.2 acres | 51.4 acres |
| 440—538.7 acres | 5100—543.6 acres | 4550—914.3 acres |
| 0.121 acre | 0.106 acre | 0.205 acre |
| 328 ft. | 278.8 ft. | 360.8 ft. |
| 16.1 ft. | 16.4 ft. | 24.6 ft. |
| 2310—143.3 acres | 1740—143.3 acres | 900—131.20 acres |
| 0.062 acre | 0.082 acre | 0.104 acre |
| 98.8 ft. | 196.8 ft. | 190.8 ft. |
| 20.3 ft. | 18.0 ft. | 22.9 ft. |
| $L + 16.4 \text{ ft.} \times 17.7 \text{ in.} \times$ $440 = 51.9 \text{ acres}$ | $(278.8 \text{ ft.} + 16.4 \text{ ft.}) \times 17.7 \text{ in.} \times$ $5100 = 51.05 \text{ acres}$ | $(360.8 \text{ ft.} + 24.6 \text{ ft.}) \times 17.7 \text{ in.}$ $\times 4550 = 59.31 \text{ acres}$ |
| $L + 19.7 \text{ ft.} \times 9.8 \text{ in.} \times$ $2310 = 6.42 \text{ acres}$ | $(196.8 \text{ ft.} + 18 \text{ ft.}) \times 9.8 \text{ in.} \times$ $1740 = 6.99 \text{ acres}$ | $(190.8 \text{ ft.} + 22.9 \text{ ft.}) \times 9.8 \text{ in.}$ $\times 900 = 3.71 \text{ acres}$ |
| $19 + 6.4 = 58.3 \text{ acres}$ | $51.05 + 6.99 = 58.02$ | $59.31 + 3.71 = 63.02 \text{ acres}$ |
| 820 | 1210 | 1140 |
| 393.6 ft. | 393.6 ft. | 426.4 ft. |
| 350 | 480 | 280 |
| 262.4 ft. | 295.2 ft. | 328 ft. |
| $L \times 15.7 \text{ in.} \times 820 = 9.74 \text{ ac.}$ | $393.6 \text{ ft.} \times 15.7 \text{ in.} \times 1210 = 14.33 \text{ ac.}$ | $426.4 \text{ ft.} \times 15.7 \text{ in.} \times 1140 = 14.58 \text{ ac.}$ |
| $L \times 7.9 \text{ in.} \times 350 = 1.38 \text{ ac.}$ | $295.2 \text{ ft.} \times 7.9 \text{ in.} \times 480 = 2.13 \text{ ac.}$ | $328 \text{ ft.} \times 7.9 \text{ in.} \times 280 = 1.38 \text{ ac.}$ |
| $9.74 + 1.38 = 11.12 \text{ acres}$ | $14.33 + 2.13 = 16.46 \text{ acres}$ | $14.58 + 1.38 = 15.96 \text{ acres}$ |
| 47.2 acres | 41.56 acres | 47.05 acres |
| 4.45 acres | 4.65 acres | 4.35 acres |
| 0.65 % | 0.68 % | 0.57 % |

for the calculation of the area required for roads, instead of the number of large plots, the number of the smaller ones was taken. By this means the objection that owing to future divisions of property among inheritors further boundaries will become necessary and thus diminish the favourable results obtained, cannot be raised.

- 738 - **A Model Improvement with Rounding-up of Holdings in the Tyrol.** — ZAILER, VIKTOR in *Wiener Landwirtschaftliche Zeitung*, Year 63, No. 32, pp. 384 and 385, Vienna, April 19, 1913.

A description of the cultivation conditions of a fen before and after improvement and the rounding-up of the holdings. Cost of drainage and of laying down new pastures. Map of the district before and after the arrangement.

- 739 - **The Share System in the Italian Province of Aquila (Abruzzi).** — CRISTE POMPILIO in *L'Agricoltura Italiana*, Series 4, Year 9, Part 6, pp. 166-169. Pisa March 31, 1913.

The writer deals with the Share System contracts obtaining in the province of Aquila: length of lease and terms of notice; the sharing of the fixed and circulating capital and of the produce between the lessor and the lessee; the obligations of the lessee and the grants made by the lessor.

- 740 - **A Joint Labour and Tariff Contract between the Proprietor and his Labourers.** — ZEISSNER, H. K. in *Wiener Landwirtschaftliche Zeitung*, Year 63, No. 29, pp. 351-353, Vienna, April 9, 1913.

The importance of the joint contract and its suitability to the requirements of farm management. Example of such a contract, which deals chiefly with the following matters: relations between landowner and the labourer's representative, the management by a labourer's committee of the labourers' savingsbank and benefit club (tariff of fines), the division of the labourers into classes, the permanence of their posts, obligation to work, the fixing of the wages and their amount.

- 741 - **Cost of Harvesting in 1911 and 1912.** — GIRARD, HENRY in *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year LXXI, No. 4, pp. 553-557. Paris December 1912.

A comparison between the cost of harvesting wheat and oats harvested in 1911 and 1912 on the Bertrandfosse estate at Plailly, France.

Final data (per acre):

| | 1911 | | | 1912 | | |
|---|------|----|----|------|----|---|
| | £ | s | d | £ | s | d |
| Cost of reaping by hand and binding | — | 14 | 8½ | — | 13 | 6 |
| Cost of machine reaping | — | 9 | 2 | — | 9 | 7 |
| Carting expenses | — | 14 | 8 | — | 15 | 2 |
| Average general expenses | 1 | 5 | 1 | 1 | 5 | 3 |

- 2 - **The Cultivation of Small Holdings in the Department of Ardèche in France.** — **HIRSH** in *Bulletin de la Société d'Encouragement pour l'Industrie nationale*, Year 112, No. 1, pp. 90-113. Paris, January 1913.

A description of about 10 well-managed small holdings of from 5 to 10 acres in extent, situated on the rocky eastern slopes of the Cévennes. Chief industries practised: silkworm-rearing, cultivation of vines and fruit trees (peaches, plums, figs, cherries), and market gardening.

AGRICULTURAL INDUSTRIES.

- 3 - **New Method of Freeing Milk from Germs.** — **LOBECK**, O. in *Molheret-Zeitung*, Year 23, No. 14, pp. 157-158. Berlin, April 5, 1913.

The writer points out the disadvantages of pasteurizing and sterilizing milk and describes a new method of freeing the latter from microorganisms. This consists in pouring the milk from the pails into a pressure chamber, where it is subjected by a pump to a pressure of 4 atmospheres, then heating it as a fine spray indirectly for some seconds in a sterilizer at a temperature of 73 to 75° C. (163 to 167° F.), and immediately cooling it. The advantage of this method over those hitherto employed consists in the fact that the pathogenic milk flora is thereby destroyed without the milk having undergone any change, as far as chemical tests show. It retains the properties of raw milk and can be used for cheese-making. Milk so treated keeps twice as long as fresh milk, and on coagulation there is but little difference in the taste.

- 44 - **The Manufacture of Butter for Storage.** — **ROGERS**, I. A., **THOMPSON**, S. C. and **KEITHLEY**, J. R. U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin No. 148, pp. 27. Washington, 1912.

The long annual period of low production of butter in the United States has made it necessary, in order to ensure a fairly uniform supply, to store large quantities during the short season when the production exceeds the demand, which is in the spring and early summer months. In May, June and the early part of July there is active buying for storage. This season is followed by a few months in which the supply and the demand are nearly equal, while in the winter there is a decided scarcity of fresh butter. Butter may be held in storage from May to April, a period of 11 months, although the average time is probably only 8 or 9 months. Under exceptional conditions, dealers may have kept butter over a year, but this is usually done at a heavy loss.

An insignificant quantity is kept in small towns in refrigerators, mainly by an ice-salt system at 20°-25° F., but the bulk of storage butter is in the great trade centres in large warehouses at temperatures of 0° F. and below.

All butter changes slowly in storage, even at temperature as low as -10° F., the waxy texture of the fresh butter changing to a pasty consistency. This is not evident, however, except on very long storage, and is not a fac-

tor in commercial storage. The most common alteration is in the flavour which sometimes becomes so objectionable as to materially lessen the market value of the product. The cause of this change has not been determined with any certainty, but it is not due to the temperature, as it occurs in butter kept at higher temperatures. The most common alteration is the occurrence of the so-called "storage flavour"; this only appears in old butter. Fishy flavour may be found in butter originally of the highest quality and much detracts from its market value.

Though the exact cause of these flavours has not been discovered, certain factors which may influence or accelerate their development have been pointed out in previous publications of the Dairy Division. The importance of the acidity of the cream at the time of churning, and the possibility of making butter of superior keeping quality by limiting the acidity has been especially emphasized in the latter. It was observed in the examination of 259 samples of experimental butter of known acidity, that of 137 samples from cream having an acidity of below 0.3 per cent., only 2, i. e. 1.5 per cent., were marked fishy; while of 122 samples having an acidity of 0.3 per cent. or over, 60, or 49.20 per cent., were fishy.

The probable nature of the relation of acidity to change in flavour has been discussed in previous bulletins of the Washington Bureau of Animal Industry. It is evident that, to make butter of good keeping quality, any treatment that increases the chemical instability of the product should be avoided. Butter of good quality can be made from sweet pasteurized cream and the deteriorating influence of the acid is thus eliminated.

Advantage has been taken of this fact by the Navy Department of the United States, which has found it expedient for several years to procure and store a year's supply of butter during the period of heavy production. The butter was made from pasteurized sweet cream and packed in hermetically sealed tin cans under the supervision of, and according to specifications prepared by, the Dairy Division of the Department of Agriculture.

The Navy butter for 1909, 1910, and 1911 kept excellently and proved the efficiency of the methods used in making and packing it.

The scoring of samples of butter contained in three series of cans and preserved in a similar manner for 8 months in 1909, 1910, and 1911 was as follows:

TABLE I.

| Year | Average original score | Average score after storing | Average points lost in storage |
|----------------|------------------------|-----------------------------|--------------------------------|
| 1909 | 94.92 | 90.90 | 4.02 |
| 1910 | 94.73 | 91.75 | 2.98 |
| 1911 | 94.75 | 92.37 | 2.38 |

One creamery was permitted, by special contract, to disregard the acidity and pasteurization requirements of the specifications and to increase the water content to 15.5 per cent. on a guarantee that the butter would score 90 after being held in storage for 8 months. This butter was made from unpasteurized cream and an acidity of about 0.56 per cent was developed; the methods of packing, shipping and storing were the same as at other creameries having contracts for Navy butter. On comparing this result with the results obtained by the creameries working under the prescribed precautions and taking one which represents medium conditions, we find a difference of only 0.49 points in the score at the time of packing, while after being held in storage the difference amounts to 5.08 in favour of the butter made from pasteurized sweet cream.

Other experiments were made in 1910 in three creameries in the vicinity of Owatonna, Minn., in order to demonstrate the feasibility of butter dealers having butter made expressly for storage. The three creameries adopted different methods: *A* made butter from unpasteurized ripened cream; *B* pasteurized the cream, added a starter and ripened the cream in the usual way; *C* pasteurized the cream, cooled it at once and used no starter. The results, which are given in the following table, show the latter method to have been the most satisfactory.

TABLE II.

| Character of cream | Number of churnings | Average score of fresh butter | Storage temperature °F. | Number of tubs scored | Average score after storage |
|-----------------------------|---------------------|-------------------------------|-------------------------|-----------------------|-----------------------------|
| w ripened cream | 18 | 92.33 | 0 | 18 | 87.33 |
| | | | 10 | 18 | 86.94 |
| | | | 20 | 12 | 86.33 |
| steurized ripened cream . . | 30 | 93.35 | 0 | 30 | 91.20 |
| | | | 10 | 30 | 90.28 |
| | | | 20 | 17 | 88.47 |
| steurized unripened cream . | (1) 17 | 92.94 | 0 | 18 | 92.36 |
| | | | 10 | 18 | 91.91 |
| | | | 20 | 12 | 91.41 |

(1) Not including one churning which was not scored before storage.

In 1911, a similar arrangement was made with the same company and butter was made for storage at two creameries, *D* and *E*. This three

different systems were followed, and the results were always in favour of using sweet pasteurized cream.

TABLE III.

| Character of Cream | Number of churnings | Average score of fresh butter | Storage temperature °F. | Number of tubs scored | Average score after storage |
|-------------------------------|---------------------|-------------------------------|-------------------------|-----------------------|-----------------------------|
| Raw ripened cream | 21 | 93.55 | 0 | 21 | 91.86 |
| | | | 10 | 21 | 89.48 |
| | | | 20 | 8 | 89.88 |
| Pasteurized ripened cream . . | 23 | 93.52 | 0 | 23 | 91.74 |
| | | | 10 | 23 | 89.91 |
| | | | 20 | 11 | 89.64 |
| Pasteurized unripened cream . | 19 | 94.61 | 0 | 19 | 94.18 |
| | | | 10 | 19 | 93.16 |
| | | | 20 | 8 | 92.88 |

The superior keeping quality of sweet cream butter is evident in uniformity, the slight change from its original condition, and the almost complete absence of the usual cold-storage flavours. This butter was made under conditions which could be duplicated for any dealer requiring butter made expressly for storage.

With regard to the influence of temperature upon butter, it is clear that a low temperature retards the changes in storage butter. A certain stage of deterioration may be reached in three weeks at 32° F, or in six months at 0° F.

The results on various lots of butter show a small difference between butter stored at - 10° F and + 10° F, but a marked difference between butter stored at 10° and 32° F. In the work reported in the present paper duplicate tubs were stored at 0°, 10° and 20° F. The results due to temperature are well seen in Table IV.

These results show that the deterioration in stored butter is in a general way directly proportional to the temperature of the store and pasteurized sweet-cream butter keeps relatively well at all temperatures even at 20° F the latter deteriorates comparatively little.

TABLE IV.

| Kind of butter | Points lost after storage | | |
|---|---------------------------|------------------|------------------|
| | Stored at 0° F. | Stored at 10° F. | Stored at 20° F. |
| Raw Cream butter — Creamery A | 5.0 | 5.3 | 5.8 |
| " " — " D | 1.7 | 4.1 | 3.3 |
| " " all samples | 3.2 | 4.6 | 4.8 |
| sterilized ripened cream — Creamery B | 2.2 | 3.0 | 5.1 |
| " " — " E | 1.7 | 3.6 | 4.0 |
| " " all samples | 2.0 | 3.3 | 4.6 |
| sterilized unripened cream — Creamery C | 0.6 | 1.0 | 1.5 |
| " " — " D | 0.4 | 1.0 | 1.6 |
| " " all samples | 0.5 | 1.0½ | 1.6 |

45. — **The New Warm-Chamber Method of Making "Grana" Cheese** (1). — OLIVA, J.A. in *Il Caseificio Moderno*, Year 6, No. 6, p. 85. Piacenza, March 15, 1913.

During the last few years, the best-known investigators of the problems relating to cheese-making (Spallanzani, Gorini and Fascetti) have been trying to solve an important question in the manufacture of "Grana" cheese, namely to find a method of preventing the curd swelling without the loss of its characteristic appearance and flavour. The idea followed was to regulate the fermentation taking place during ripening; to this end the selected ferments of Professors Gorini and Fascetti have come into use and into the trade. These ferments, if used according to the instructions given by their preparers, have the property of hindering the development of the injurious ferments which affect the milk before and during the making of the cheese.

The new method has been proposed by Prof. Samarani of the Royal Cheese-Making Experiment Station at Lodi; it consists in promoting the development of selected ferments through the action of a warm chamber, thus giving them an absolute predominance in the fermentation process.

The method is practised as follows:

1) The filtered milk is cooled in a refrigerator to a temperature below 10° C. (64 ½° F.), when it is placed in metal basins to let the cream rise; these basins, which must not be of polished copper, are immersed in water, kept always at a temperature below 18° C. By this treatment the milk

(Ed.).

(1) See also No. 588, B. May 1913.

descends into the boiler without any natural fermentation taking place and it retains its natural acidity unchanged.

2) Before the addition of the rennet, the selected lactic ferments (lactic bacilli) are added to the milk in the proportion of 1 per 1000 by volume. These micro-organisms possess the maximum fermentative power (virulence) obtained by growing them in a suitable sterilized liquid prepared on a base of peptone and lactose neutralized with carbonate of lime. To ensure vigorous action, fresh ferment should be added regularly, without interruption at 24 hours interval, and developed at a temperature of 32 to 35°C. (90 to 95°F.). Before each ferment is used the quantity necessary for the succeeding inoculation is set apart in the proportion of 5 per cent.

3) The form, on leaving the boiler, passes into a warm chamber at 37 to 40°C. (99 to 104°F.), the optimum temperature for the development of the bacillus forms of lactic ferments; here it remains for 12 to 14 hours until the lactic fermentation is complete; this is recognized by the plasticity of the curd.

The experiments undertaken by Prof. Samarani have begun favourably since about forty forms of Grana, which have been partly made from centrifuged milk, i. e. with milk which is difficult to work, have been kept during the summer months without signs of swelling.

Before, however, passing a definite judgment, it is necessary to wait two years longer and then carefully examine the qualities of cheese made according to the new warm-chamber method.

746 - "Bankrote" Cheese (1). — TEICHERT, KURT in *Molkerei-Zeitung*, Year 27, No. 1 pp. 489-490, Hildesheim, April 4, 1913.

The writer has of late examined many "bankrote" Emmentaler and Münster cheeses, and has ascertained that their condition is not due to bacteria. If such cheeses are grated to a powder and the latter is mixed with an alcoholic solution of phloroglucin in hydrochloric acid, a red discoloration is seen. The cheese rinds showed a very strong reaction, which decreased as the centre of the cheese was approached. Cheeses which were not affected gave no red reaction with phloroglucin and hydrochloric acid. The writer, therefore, concludes that the red colour is principally due to the sap of the wood of the shelves having penetrated into the cheese placed upon them. Cheese-shelves made of white spruce wood impart the characteristic deep brown-red colour to the cheeses stored upon the

747 - The Microflora of Stilton Cheese. — PERCIVAL, J. and MASON, G. HEATH in *The Journal of Agricultural Science*, Vol. V, Part 2, pp. 222-229 + figs. Cambridge March 1913.

After a description of the methods adopted in the investigations, a detailed account is given of the micro-organisms found in Stilton cheese. The number of these is large in fresh cheese (1 000-3000 million per gram).

(1) This epithet is applied to cheeses in which the rind has assumed a brownish colour from long storage on damp shelves. The colour is quite distinct from that obtained with the phloroglucin reaction.

in the first week), but there is a gradual fall in the numbers up to the time of ripeness (300 to 150 days old), when 50 to 100 millions only are found.

Five characteristic organisms were found in all Stilton cheeses examined, viz: 1) *Streptococcus lacticus*, 2) a short-rod form of *Bs. acidilactici*, 3) a species of *Tyrophrix*, 4) *Penicillium glaucum*, and 5) a round form *Torula*, sometimes accompanied or replaced by an oval form.

18 - The Cattle Market and Cattle Trade at La Villette in 1912 (1). — ROLLIN in *Bulletin des séances de la Société Nationale d'Agriculture de France*, Vol. 73, No. 1, pp. 47-54. Paris, 1913.

The following tables show the importance of the cattle trade at the La Villette cattle market in 1912, and give the prices as compared with those of the preceding year.

Number of animals taken to the cattle-market.

| | Cattle | Sheep | Calves | Pigs |
|---|---------|-----------|---------|----------|
| 12. | 356 352 | 1 534 852 | 183 884 | 372 417 |
| 11. | 349 458 | 1 512 213 | 180 874 | 405 290 |
| increase (+) or decrease (—) in 1912 | + 6 894 | + 22 639 | + 3 010 | — 32 873 |

Number of animals taken direct to the slaughter-houses.

| | Cattle | Sheep | Calves | Pigs |
|----------------------------|--------|---------|---------|---------|
| 12. | 79 961 | 935 141 | 199 752 | 338 915 |
| 11. | 79 816 | 898 607 | 195 360 | 284 325 |
| increase on 1912 | 145 | 36 534 | 4 392 | 54 590 |

From a table for 1912 given in the original article, it is seen that the prices of first-class cattle are above the average for the year in the months April, May, June, July and August. The prices are below the average in the last quarter of the year and in January and February. Cattle of the

(1) See Nos. 93 and 180, B. Feb. 1913, and No. 594, B. May 1913

*(Ed.).

Average, Maximum and Minimum Prices at the La Villette Market.

| Kind | Average Prices | | | | Maximum and Minimum Prices | | | |
|---------------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|-------------------------------|
| | Pence per lb. meat | | | | | | | |
| | 1st Quality | | 3rd Quality | | Highest Price | | Lowest Price | |
| | 1912 | 1911 | 1912 | 1911 | 1912 | 1911 | 1912 | 1911 |
| Cattle | 7 ³ / ₄ | 7 ³ / ₄ | 6 ³ / ₄ | 6 | 8 ³ / ₄ | 9 | 4 ³ / ₄ | 4 ¹ / ₄ |
| Sheep | 10 ³ / ₄ | 10 ¹ / ₂ | 8 ³ / ₄ | 8 | 11 ³ / ₄ | 12 | 6 ¹ / ₂ | 7 |
| Calves | 10 ¹ / ₂ | 10 ³ / ₄ | 7 ³ / ₄ | 7 ¹ / ₂ | 12 ¹ / ₂ | 12 ¹ / ₂ | 5 ³ / ₄ | 5 ¹ / ₄ |
| Pence per lb. live weight | | | | | | | | |
| Pigs | 6 ³ / ₄ | 6 | 5 ³ / ₄ | 5 ¹ / ₂ | 7 ¹ / ₄ | 7 | 5 ¹ / ₄ | 4 ¹ / ₄ |

third quality fetch higher prices than the annual average in April, May and June, and lower in January, February, September, October and December.

The price of sheep is above the average in February, March, April, August, September, November and December.

The highest price for first-class calves was reached in January, February, March, April and May. Otherwise the price was always below the year average. The price fetched by calves of third quality was higher than the yearly average on January and April, and lower in the other months.

The price of pigs was higher from February to September; in the other months it was below the average price.

749 - **Gold and Ferments in 1912.** — ASTROC, H. in *Revue de Viticulture*, Year: Vol. XXXIX, No. 1009, pp. 541-545. Paris, April 17, 1913.

It is the firm conviction of the writer, based on his observations in 1913 in the vineyard and upon his laboratory notes, that the alcohol fermentation of the vintage proceeds badly, or is prevented from taking place at all, when the temperature is below 18 to 20° C. (64 to 68° F.); this is the case even in the south of France, especially when the ferments do not all sporulate to begin with, as occurs generally on healthy grapes at the beginning of the season, if the vintage is placed in a recently opened cellar in clean vats, as it always should be.

If it is desired to avoid the difficulties due to low temperature and to obtain the necessary fermentation without having recourse to a must warmer, which is a costly apparatus as it is seldom used, the writer considers the only economical method is to initiate fermentation artificially by adding ferments in full budding, which would give the necessary heat to the liquid. These ferments could, if wished, be obtained from a native must, and their preparation would only entail the early gathering of

small quantity of grapes, or else the use of pure-culture or selected trade yeasts. The essential point is that they should be very active and bud rapidly; this entails the use of young yeasts and usually necessitates the addition of some starter (*pied de cuve*) made on the premises, or got from a neighbouring starter-establishment (*zymogène*).

Another very important point is to avoid drowning these yeasts in a large quantity of chilly must and thus paralysing their activity. Contrary to what is usually recommended, it is necessary, in years when the temperature is below 20°C. (68° F.) or thereabouts, to throw the starter simply on the surface of the pomace, or the must, without stirring it up; by this means the yeast will lose as little heat as possible and will produce actual centres of fermentation, whence the activity will radiate through the mass.

The must should only be aerated at the time of pressing, and all other customary aerations should, in this case, be avoided. The temperature of the upper third of the liquid alone need be watched, but when this exceeds 32° C. (90° F.) or thereabouts, it can be regulated by mixing in the lower third, avoiding all unnecessary aeration. If, at the same time, the necessary amount of sulphurous acid is reduced to the minimum, and if its hindering effect is corrected by introducing into the vat from 10 to 15 gr. of ammonium phosphate per hectolitre (about 2 ½ oz. per 100 gallons), which is an excellent nutrient salt for yeasts, the best measures have been taken to prevent any deleterious action on the fermentation which might be produced by early cold.

750 - **The Maturation and Clarification of Wines by Means of Cold.** — CARLES. in *Bulletin de la Société des Agriculteurs de France*, p. 274. Paris, April 1, 1913.

The writer has already advocated for some time the use of low temperatures, either natural or artificial, in the maturation of wines. He shows in this article that the effect of the cold can be increased during refrigeration by putting the wine in active motion. This can be done in various ways, e. g. by beating the contents of the vats with a wine-shed broom, rocking the barrels containing the vintage, or by any other practical method.

If a solution of potassium bitartrate in artificially cooled pure water is subjected to similar mechanical action the deposition of the salt is more rapid and more complete. Should it be dissolved in wine, and especially new wine, or a mixture into which new wines enter, the relative amount of tartar deposited is still greater. This is due to two totally different causes, which have, however, the same result.

The first, which is entirely physical, depends on the property of the tartar of removing other substances. New wine is, in fact, a super-saturated solution of tartar. The cold releases this super-saturation and diminishes the capacity of solution, especially if the temperature is very low and the cold is prolonged. When the tartar is thus insoluble in a medium containing substances in a state of unstable equilibrium, or in pseudo-solution, it has the power of combining with them and removing them. This union is known under the name of "laques".

The second case is chiefly chemical. When chilled new wine, in a barrel three-quarters full, is beaten vigorously or when a large surface of the chilled wine is exposed to the air, a certain quantity of oxygen is introduced into it. This oxygen is more soluble in wine near freezing-point than at ordinary temperatures. In dissolving, therefore, it combines by preference with those elements of the wine which are most readily oxidized; of these the blue pigments are the chief. By oxidation these pigments progressively lose their solubility, and thus from being pseudo-soluble they become wholly insoluble. The tartar possesses an especial affinity for these pseudo-soluble substances, which it abstracts from the wine till it itself reaches the equilibrium of saturation. But the reciprocal action is such that it is impossible for these oxidized pigments and ferruginous tannoids, which have individually been rendered insoluble, to separate out from the wine without, in their turn, removing part of the normally dissolved tartar even in the oldest wines.

It is for this reason that the first lees form after racking, which is a simple mechanical process, and that the sediment is so abundant.

The action of cold is thus only apparently physical and can be increased two-fold by the chemical action of the oxygen of the atmosphere, and even more by imparting motion to the wine in different ways.

The first result is, not only the elimination of the tartar and similar acid salts, which are present in excess, but also the removal of all the potentially insoluble compounds forming the blue pigment of new wine. The complex products of this separation form the first lees, and this general precipitation produces a self-clarification of the first order.

Herein lies the secret of the maturation of new wines by means of cold and the general elimination of their pseudo-soluble compounds. The experiment shows that these two processes are followed by a state of equilibrium and stability equal to that possessed by old wines. Further, it demonstrates that if wine kept at this low temperature is frequently racked off, it assumes the extraordinary limpidity and ruby colour so much admired by wine-makers and which is otherwise attained by exposing the product to the long-continued cold of many winters.

PLANT DISEASES

GENERAL INFORMATION.

51 - **Law Respecting the Protection of Plants in Egypt from Imported Diseases.** — *Journal Officiel du Gouvernement Égyptien*, Year 40, No. 31, pp. 655-656. March 17, 1913.

On March 11, 1913, the Khedive of Egypt decreed as follows :

Art. 1. — The importation of cotton plants, cotton seed, unginned cotton and the wood of the cotton plant is forbidden. The importation in transit of unginned cotton and of cotton seed is likewise prohibited, unless accompanied by an official certificate testifying to their fumigation in the country whence they are exported.

Art. 2. — The importation of all live insects, as well as of their eggs, larvae and pupae is forbidden. The importation of all cultures of bacteria and of all fungi injurious to plants is also forbidden. The importation of silk worms and of bees is forbidden, except by special permission of the Department of Agriculture, and according to the conditions prescribed by that authority.

Art. 3. — The provisions of the two preceding articles do not apply to cotton plants, cotton seed or insects imported by the Department of Agriculture for scientific purposes.

Art. 4. — Date palms, banana plants, and sugar canes may not be imported except by special permission of the Department of Agriculture and in accordance with the regulations prescribed by the latter.

Art. 5. — Potatoes on their arrival at the Custom House may be subjected to examination ; should they prove to be infected with black rot (*Chrysophlyctis endobiotica*) they will be destroyed, with no compensation to their owners. Should the potatoes be found to be attacked by *Phthorimaea operculella*, they are to be fumigated at the expense of the receiver.

Art. 6. — Live plants imported into the country, and not included in the preceding articles (including the stems, bulbs, roots and all other portions of plants capable of growth, with the exception of seeds), shall be fumigated at the expense of the receiver. Exceptionally, plants arriving by parcel post will be fumigated at the expense of the Government. Trees

and shrubs arriving at ports where there is no fumigating apparatus of sufficient size, will be sent on by sea to Alexandria, Port Said or Suez.

Art. 7. — The Minister of Public Works can, by means of a decree published in the *Journal Officiel*, declare foreign countries infected by diseases, or by fungi injurious to plants, and order the fumigation on their arrival, and at the receiver's expense, of all fruits and seeds mentioned in the decree and coming from these countries, or of unknown origin. All fruits and seeds are likewise subjected to fumigation, which, on examination by the agents of the Department of Agriculture, prove to be infected by a disease or fungus mentioned in this decree.

Art. 8. — All plants and fruits coming from abroad should be packed in such a manner as to facilitate their examination and, if necessary, their fumigation. In default of this the packages are liable to being opened at the risk of the receiver.

Art. 9. — Such parcels as are introduced into the country contrary to the provisions of the law in question must be re-despatched within 15 days, or otherwise they are liable to be destroyed without their owners having any claim for compensation.

Art. 10. — The regulations of the present law shall be enforced at the Custom House by the agents of the Department of Agriculture or by those of the Customs and Postal Services. In the case of boxes arriving overland, these regulations will be carried out by the Department of Agriculture at the first station on Egyptian territory.

Art. 11. — Laws Nos. 10 of 1904 and 21 of 1909 forbidding the importation of cotton seed are abrogated.

Art. 12. — The Ministers of Public Works and of Finance are charged, in so far as it is in their power, to enforce this law, which comes into force 30 days after its publication in the *Journal Officiel*.

752 — Proclamation of March 6, 1913, for the Protection of Bananas in British Honduras. — "The Plant Protection Ordinance 1912", Proclamation No. 1 of 1913 British Honduras.

The importation into the Colony of bananas and plantains and of any seeds, cuttings or plants thereof, or any description of earth or any articles packed therewith or any package, covering or thing in which they may be packed is prohibited except in accordance with the conditions of a special licence given by the Governor on the occasion of each importation.

DISEASES NOT DUE TO PARASITES AND OF UNKNOWN ORIGIN.

753 — The "Degeneration" of the Agen Plum. — BABATÉ, E. Le Prunier d'— dégénère. — *Revue de Viticulture*, Year 20, Vol. XXXIX, Nos. 1007 and 1008, pp. 493 499 and 525-530, figs. 71-80. Paris, April 3 and 10, 1913.

For thirty years a special affection of the Agen plum tree (*Prunus d'Este*, or Robe de Sergent) has been recorded. The disease is recognised

able by a combination of clearly distinguished external characters and is known as degeneracy, anomaly, deterioration, sterility, male plum, etc. The branches of the affected tree are bare at intervals; the twigs are thick and short, with an almost regular diameter; the leaves are wide and glossy, and grow in tufts; the flowers occur in thick clusters, while the fruits are rounded and very few.

So far the investigations of this disease do not permit of its being attributed to any definite parasite. The writer considers it provisionally as due to great irregularity in the food supply of the tree, especially as regards water.

To avoid this disease spreading in new plantations, the following conditions are necessary: fresh, calcareous, permeable soil; stocks adapted to the soil; scions taken from healthy, strong, productive trees with long leaves and pyriform fruit.

Sowing the stones of Agen plums produces good stocks, and even new types of this variety without grafting.

Abnormal Agen plum trees, if not too old, may be re-grafted with greengage or other varieties.

No exact results have been obtained by the use of fertilizers, insecticides and fungicides; and certainly new systematic investigations are very necessary.

BACTERIAL AND FUNGOID DISEASES.

754 - **Chinese Fungi** (1). — MIYAKE, ICHIRO in *The Botanical Magazine*, Vol. XXVII, Nos. 314 and 315, pp. 37-44 and 45-54, plate 1. Tokyo, February and March 1913.

This is a new contribution to the mycological flora of China and includes 31 species parasitic on cultivated or other useful plants, collected in 1908 in South China and in 1910 in the neighbourhood of Peking. The following are new to Science: *Uncinula Koelreuteriae* on the leaves of *Koelreuteria bipinnata* Frank; *Phaeosphaeria Eriobotryae* on the leaves of *Eriobotrya japonica* Lindl.; *Melampsora Periplocae* on the leaves of *Periploca* sp.; *Phaeospora Compositarum*, on the leaves and stalks of *Aster* sp. and of *Artemisia* sp.; *Coniothyrium Rhamni*, on the leaves of *Rhamnus* sp.; *Melophia Polygonati*, on the leaves of *Polygonatum officinale* All.; *Marssonina viticola*, on the leaves of *Vitis vinifera* L.; *Cercospora Clerodendri*, on the leaves of *Clerodendron* sp.

755 - **The Barberry and its Relation to Black Rust of Grain.** — Communication from H. T. GUSOW (Dominion Botanist, Canada), Experimental Farm, Ottawa, to the International Institute of Agriculture.

Many years before the distinguished Mycologist, Anton de Bary, of the University of Strassburg, had shown by scientific investigation (in 1865)

(1) See No. 1099, B. July 1912.

that the barberry (*Berberis vulgaris* L.) played an important role in the spreading of black rust of grain (*Puccinia graminis*), practical farmers in the Continent of Europe were convinced that the rust specks on the barberry had some connection with the grain rust. Naturally the interpretations of this observation were merely fantastic. Within recent years, and as the knowledge of the life history of these destructive grain parasites advanced, the fact that barberry rust and grain rust were closely related became more and more established. It was clearly proven that the barberry served as an intermediate host for the fungus on grain. However, there has been entertained considerable doubt or lack of appreciation as to the correctness or practical use of this observation, which was regarded as a mere theory. It was pointed out by several other investigators that in certain districts of Hungary and Sweden very few barberry bushes existed, and still black rust seemed to persist. Dr. Barclay, the pioneer Indian mycologist, cited a particularly interesting example, referring to the grain growing districts of the East Indies where there is no barberry to be found within 300 miles of that area. However, beyond this distance in the mountainous regions there were barberry bushes growing. We may note that although in these cases "there were hardly any barberries left" or "they were 300 miles away from the grain growing district" yet there certainly existed some barberries all the time. One of the first European countries which took the matter seriously was Denmark. By means of an Act this country enforced the systematic destruction of the barberry. It has been stated by Dr. Lindau (in 1908) that notwithstanding the destruction of the barberry, black rust of grain continued its devastations, although the intensity of the infection varied to some extent. This latter observation, of course, may be commonly made any one year, the rust varying considerably according to districts or climatic conditions.

In the report of the Dominion Botanist for 1911, p. 239, the present status of our knowledge of rusts was briefly summarized, and it was stated: that it had been found in Denmark, for instance, that the compulsory destruction of barberry has not brought a reduction in the severity of rusts. This statement was eventually read in Denmark, and we are indebted to Dr. J. Lind of the Phytopathological Experimental Station, Lyngby, Denmark, for a letter in which he refers to this statement explaining that: "*Puccinia graminis* is quite perceptibly disappearing in Denmark year by year to the same degree as we get rid of the *Berberis*, and we are very satisfied with the results of the *Berberis* Act."

This communication contained important information of a more definite character than any we had been able to secure previously. We thought it, however, desirable to seek the opinion of another Danish plant pathologist and communicated with Dr. F. Kølpin Ravn of the Pathological Museum of Copenhagen. He very courteously writes us under date March 26th

"In your letter of February 27th you desire to know what my personal experience has been concerning the extermination of barberry bushes in this country. I have been able very often to observe early outbreaks of *Puccinia graminis* on rye and oats; in all such cases - without any exception -

we have been able to find some barberry bushes near by ; and some years after the removal of these bushes these early outbreaks of rust had disappeared.

"Several of the local advisers in Plant Culture carried on a systematic fight against the barberry bushes, as required under the Act. And at present the early - and only dangerous - outbreaks of black rust are rarely reported. I may add that the farmers practise for some recent years sowing spring grain earlier than before, which further helps in the fight against the rust. I think, therefore, that the present very slight infections by *Puccinia graminis* are the result of the two named factors taken together."

From these two letters it would appear that the systematic destruction of the barberry, green and purple leaved - for the acidia of the rust fungus occur on both - would produce a very desirable effect, i. e., the checking of the severity at any rate of that most dangerous rust of grain culture.

The barberry shrub, it must be realized, is worthless as compared with the immense value of cultivated grain. In order to protect the grain industry as much as possible, the destruction of the barberry wherever it grows is strongly advocated.

756 - **Spraying Fruit Trees with Lime-Sulphur Wash** (1). — MARRE, E. in *Le Progrès agricole et viticole*, Year 30, No. 17, pp. 529-532. Montpellier, April 27, 1913.

From the results of a second year's experiment as to the efficacy of lime-sulphur wash against the diseases of fruit trees (peach, apple, pear) the writer recommends this wash as a successful means of controlling leaf-curl of peaches (*Exoascus deformans*) and applescab (*Venturia inaequalis*).

In order to obtain good results, the mixture must be applied three times: a) just before flowering; b) when the blooms are falling; c) three weeks later.

757 - ***Bacillus Capsici* n. sp., causing Shrivelling of Capsicum** — PAVARENO, I. and TORCONI, M. Sull'avvizzimento delle piante di *Capsicum annum* L. — *Atti dell'Istituto Botanico dell'Università di Pavia*, Series II, Vol. XV, pp. 207-211. Milan, 1913.

In 1912, the cryptogamic Laboratory of Pavia received stems of capsicums from Bergamo and Treviglio (Province of Bergamo), and also from Tortona (Province of Alessandria), which were more or less affected by a disease described previously as wilting or disease of capsicums by Montemartini (1907), and as capsicum rot by Noelli (1910). The former attributed the disease to *Fusarium vasinfectum*.

On examining the material sent, the writers also discovered a *Fusarium*, but as this only appeared on parts of the roots which were eaten away and dead, they do not consider that this fungus is the cause of the disease. They rather attribute it to the presence in the cells of the affected tissues of a micro-organism which they isolated and which cannot be confused with *Bacterium Solanacearum* Smith. They describe the parasite and name it *Bacillus Capsici*.

(1) See No. 423, B. Feb. 1912, and also No. 72, B. Jan. 1913 and No. 317, B. March 1913. (Ed.).

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

758 - A Contribution to the Control of Dodder. Destruction of the Seeds. —
BRESSOLA, M. in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVI, Part 2,
pp. 89-136, plates V-VII. Modena, 1913.

According to the researches of the writer, the seeds of *Cuscuta arvensis* and of *C. Trifolii* (1) are certainly more susceptible to heat than those of the chief leguminous-meadow plants (lucerne, red clover, Dutch clover and bird's-foot trefoil). After dry heating, the seeds of *C. Trifolii* and *C. arvensis* largely lose their powers of germination. After being heated to the maximum temperature endured by leguminous seeds, a certain number of the hard dodder seeds remain unhurt; the number is relatively high in the case of *C. Trifolii* and very small in that of *C. arvensis*. The following temperatures have proved most efficacious: 65° C. (149° F.) for two hours; 70° C. (158° F.) for 30 minutes; 70° C. (158° F.) for one hour; 75° C. (167° F.) for 30 minutes; 75° C. (167° F.) for one hour. Further experiment is needed to find out which is the best. The length of the heating had more effect upon *C. Trifolii* than the height of the temperature. Seeds of Leguminosae, when exposed dry to these temperatures, are not harmed; in fact, their germination capacity and energy were increased. Dry heating of hard seeds of Leguminosae has thus a favourable effect upon their germination.

The writer further observed that *C. arvensis* does much less harm to crops than *C. Trifolii*, and that the injury due to the former is less than is supposed, for which reason the restrictions placed upon the seed trade by some States appear to be unnecessarily stringent. Only a very severe attack of *C. arvensis* can cause the destruction of a crop, and even if less and badly infested the pest tends to die out; thus, though the first cut may be lost, the second and third, especially the latter, are usually saved. The attacks of *C. Trifolii*, on the other hand, even if at first insignificant, may become very severe and finally lead to the destruction of a leaf. Slight attacks of *C. arvensis* never cause appreciable damage, especially when due to the intermimittent germination of hard seeds.

In the first year of the cultivation of ground much infected with *C. arvensis*, the writer succeeded in obtaining perfectly immune plots by heating the seeds before sowing. *C. Trifolii* does much less harm to crops of bird's-foot trefoil than to those of clover and lucerne. In fields of bird's-foot trefoil *C. arvensis* germinates normally, but disappears gradually of its own accord without doing any harm. From the few observations which it has so far been possible to make the writer concludes that *C. arvensis* is much less resistant to cold than *C. Trifolii*.

(1) According to the *Index Kewensis*, *Cuscuta Trifolii* is a synonym of *C. Epithymum*.

- 759 - Correlation between the Degree of Ripeness of the Seeds of Leguminous Weeds and the Rapidity of their Germination. (1) — MUNERATI, O. and ZAPPAROLI, T. V. in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVI, Part 2, pp. 137-145. Modena, 1913.

During the summer of 1911, the writers undertook observations on the germination of seeds of leguminous weeds which reach the soil at various stages of ripeness, after falling or being detached by force from the plants; the species chosen were *Vicia segetalis*, *V. hirta*, *V. Cracca* and *Lathyrus Aphaca*, all typical arable weeds in the Lower Po valley. From the first experiments, the following conclusions are drawn:

a) In leguminous seeds which have not attained complete maturity on the parent plant, the integument is very permeable to water, so that they readily germinate as soon as they find favourable conditions of humidity in the soil; perfectly mature seeds, on the other hand, remain for a long time without germinating, because they have not the power of absorbing water.

b) Ploughing or mowing the stubble, which should be effected as soon as possible after the wheat is harvested, are of special importance in the control of leguminous weeds; by cutting down plants with ripening pods, many seeds are prevented from completing the seed-coat, which would have served to keep them for a long time in a dormant state in the soil.

c) Ploughing need not necessarily be shallow, for the unripe seeds readily take up water and thus germinate equally quickly whether they lie on the surface or are buried to some depth.

d) Weed seeds attacked by *Bruchus* are in most cases deprived of all vitality, but the few which are capable of germination develop immediately on meeting with suitable conditions.

Further researches were also devoted to determining the behaviour of leguminous seeds of different degrees of maturity; the following observations were made with lucerne seed: a) the riper the seed at harvest time, the larger is the number of seeds possessing an integument impermeable to water and *vice versa*; b) within certain limits, seeds germinate more rapidly, the longer the time which has elapsed between the harvest and the moment when they find themselves under favourable germinating conditions.

- 760 - The Effect of Alternate Periods of Humidity and Drought upon the Germination of the Seeds of Wild Plants. — MUNERATI, O. and ZAPPAROLI, T. V. in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. XLVI, Part 3, pp. 157-195. Modena, 1913.

The slow or rapid changes in the moisture of the medium in which seeds happen to be, have very different effects upon those belonging to different species of weeds.

Some seeds are induced to germinate quickly when they are placed for short time in a damp medium, after having remained for long consecutive

(1) See No. 432, B. April 1913.

periods in a dry medium (alternation of three months in a dry medium with one week in a damp one).

In a constantly damp medium, only some of the same seeds germinate and these very slowly; while those which do not germinate often rot. The following behave in this manner: *Avena fatua* (large and small seeds), *Galium Aparine*, *Papaver Rhoeas*, *Plantago lanceolata*, *Amaranthus retroflexus*.

There are other seeds (*Rapistrum rugosum*, *Myagrum perfoliatum*, *Sinapis arvensis*, *Salvia pratensis*, *Abutilon Avicennae*, *Setaria italica*, *Oenothera biennis*) which, like the former ones, germinate in much larger proportions when the humidity is not continuous, but the total percentage of germination is always less.

Some seeds (*Calystegia sepium*, *Lappa major*, *Sorghum halepense*, *Solanum nigrum*), whatever the variations in the dampness of their medium may be, only germinate in very small numbers, even if numbers of them remain alive for a long time. Others again (*Vicia segetalis*, *V. Cracca*, *V. hirta*, *Lathyrus Aphaca*, *Cnicus arvensis*, *Eruca sativa*, *Daucus Carota*, *Cuscuta Epithymum*) always germinate successively and in about the same numbers, independently of the variations in the dampness of the medium. Seeds which are impermeable to water, and typically those of the Leguminosae, have (according to the results of the writers' researches) proved themselves to be less susceptible to variations in humidity; but other species of seeds have likewise behaved in the same manner.

There is yet another class of seeds which germinate in a greater or less proportion when dry and damp periods alternate, while they do not germinate in a medium which is constantly moist, although they are evidently most living. The seeds of *Panicum Crus-galli* and of *Rumex crispus* behave in this manner in the experiments (80 to 90 per cent. of the seeds obviously living after remaining two years in wet sand); while the seeds of nearly all the other species placed in the same conditions either germinated or rotted. This probably explains why the above-mentioned plants are among the most abundant weeds in irrigated land.

INSECT PESTS.

761 - Parasitic Fungi in the Control of the Larvae of *Chelonia caja*.

PASTRE, JULES. Les chenilles bourruées. — *Le Progrès agricole et viticole*, Year 3 No. 16, pp. 491-492. Montpellier, April 20, 1913.

PICARD, F. L'Empusa aulicæ et la mortalité des chenilles bourruées. — *Ibidem*, No. 1 pp. 521-522. April 27, 1913.

A serious invasion of woolly bears (*Chelonia [Arctia] caja*) is at the present time ravaging a portion of the vineyards of Hérault.

On many of the already dried up or visibly diseased and dying larvae M. Pastre found a fungus, probably *Sporotrichum globuliferum*. Nevertheless, he believes that the first caterpillars only were attacked by the parasite and that the new generations have resisted the pest until the present time.

M. Picard considers that the mortality among the woolly bears this

pear is due to two very distinct diseases, the first being attributable to *Empusa aulica* rather than to *Sporotrichum globuliferum*, while the second is caused by a totally different organism, which he is investigating, and concerning which he will shortly publish further particulars.

764. On the Comparative Effects of Arsenic and Lead in Compounds used in the Control of *Conchylis*. — MOREAU, L. and VINET, E. in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1913, First Half-year, Vol. 156, No. 11 (March 17, 1913), pp. 906-908. Paris, 1913.

It has been repeatedly recorded that in vineyard plots which had been successfully sprayed with arsenate of lead, the *Conchylis* larvae which escaped destruction were small, weakly, yellow and capable of effecting very little injury. In neighbouring plots treated with other insecticides (nicotine, for instance) the surviving larvae were, at the same date, normal, well-developed and as strong as the control specimens.

The writers wished to test the value of this statement by weighing the larvae and ascertaining whether the special effect attributed to arsenate of lead was due principally to the arsenic, or to the lead. The weights obtained proved that the effect noticed was essentially due to the arsenic. A similar result was obtained with copper arsenate, but iron arsenate appeared to be a very weak insecticide.

These observations show that, in order to estimate at its proper value the efficacy of arsenical applications in general, it is not only necessary to count the dead larvae, but also to observe those which have survived the action of the poison and which, at the usual time of the propagation of the *Conchylis*, are late in their evolution. It is not certain that this evolution will be complete, and even if it were, it is probable that the moths resulting from these larvae would be less fertile. In any case, the second generation, being very late, would do less injury.

It does not appear from the preceding researches that other arsenic compounds can be substituted for arsenate of lead; for, according to the observations of the writers, the treatment is most efficacious and the mortality largest with arsenate of lead as compared with other arsenical sprays.

3 - Control of *Epicometis hirta* in Hungary. — FÁRIÁN, MIKLÓS in *Köztelch*, Year 23, No. 32, pp. 1159-1160. Budapest, April 26, 1913.

Epicometis hirta, which attacks by preference the flowers of fruit trees, has this year invaded the fruit garden of the Normal School of Agriculture at Komárom. The garden consists of two parts: the nursery, which is tilled, and the orchard which is in grass.

All the fruit trees were in blossom when the appearance of *Epicometis hirta* was recorded, and in spite of energetic measures, the ravages of the pest could not be checked. Further, the practice of shaking the branches and collecting the fallen insects had its inconveniences, for on the one hand, the shaking caused many of the blossoms to fall, while on the other, many of the insects found shelter in the interior of the flowers, or even flew off before it was possible to collect them. During the operation, the writer noticed the curious fact that the insects only appeared towards 10 a. m.;

when the temperature rose; and were first found on the trees of the orchard, not appearing until later on those in the nursery. After a careful search, many of the pests were discovered upon flowers growing in the orchard, especially on dandelion (*Taraxacum officinale*), some of these harbouring as many as 4 or 5 insects at a time. Most of these individuals had their backs covered with mud, which leads to the conclusion that *Epicometis hirta* passes the night in the ground and then first proceeds to the flowers nearest the soil, choosing dandelions by preference. This explains why the orchard was attacked before the nursery. As a result of this observation, the writer began to hunt these insects at 8 a. m. collecting them especially where dandelions were in flower. The first day 3 quarts of *Epicometis* were thus obtained, and after a few days the first trees were entirely freed from these pests.

764 - *Promecotheca cumingii*, a New Pest of Coconuts in the Philippines. — JONES, C. R. A New Coconut Pest. — *The Philippine Agricultural Review*, Vol. VI, No. 2, pp. 105-106. Manila, February 1923.

The writer records *Promecotheca cumingii* Baly, a beetle belonging to the family *Chrysomelidae*, subfamily *Hispidae*, as being a new insect, which is very destructive to the leaves of the coconut palms in the Philippines; the damage is done chiefly by the larvae, though the adult insects do some injury.

The eggs, larvae and pupae suffer much from hymenopterous parasite the infestation being over 50 per cent. Should the beetle, nevertheless, increase in such numbers as to cause a serious outbreak, its control could probably be easily effected by collecting and destroying the infested leaves.

765 - Scale Insects Injurious to Orange and Lemon in Spain. — DE SALAS AMAT, LEOPOLDO. *Las plagas del naranjo y limonero en España*, 196 pp., 8 figs. Madrid, 1912.

The writer first describes the chief scale insects of orange and lemon in Spain. The following is a list of them:

Chrysomphalus dictyospermi var. *pinnulifera*: called "poll-roig in Valencia, Tarragona and the Balearic Isles, "piojo rojo" and "cochinilla roja" in Murcia and Andalusia.

Aspidiotus hederae: "pili-blanc" at Valencia, "cochinilla blanca" and "piojo blanco" in Andalusia.

Parlatoria zizyphi: "poll-negre" at Valencia.

Mytilaspis citricola: "serpeta" at Valencia and in Andalusia, "purple scale" or "escama purpurea" in California.

M. gloverii: "serpeta larga".

Dactylopius citri: "cotonet" at Valencia, "algodon", "cochinilla algodonosa" or "de la tizne" in Andalusia, and "chinche harinosa" in the United States.

Saissetia oleae: "black scale" or "escama negra" in California, "cochinilla del olivo", "cochinilla de la tizne", "melaza" or "tizón".

Sr. De Salas then passes to the question of the destruction of these pests by means of their natural enemies, and enumerates various well known insects which control the above-mentioned scales.

He also speaks of artificial control methods and considers that liquid insecticides are generally more trouble than they are worth; the one exception is lime-sulphur wash, of which details are given.

Fumigating with hydrocyanic acid, a practice of relatively recent introduction into Spain, is the best means hitherto adopted in the control of the scale insects of citrus trees; the writer describes the details of this treatment, which was known and applied in America as long ago as 1886, if not before.

The results of the experiments and observations made hitherto regarding this remedy are as follows: a) the use of hydrocyanic acid solves the problem of the control of the citrus scales of Spain; b) fumigating is the most economical method for obtaining the desired results and is attended with no danger; c) thanks to this system, *Chrysomphalus dictyospermi* var. *pinnatifera* can now be considered as extirpated in Spain; d) hydrocyanic acid is an equally effective remedy against other scale insects; e) it is necessary to continue the study of *Dactylopius citri* in order to determine the best rate for the application of the remedy and the minimum cost of its application; f) in order to meet the necessary expenses of the fumigation method, it is absolutely necessary to develop the spirit of co-operation amongst the different local agricultural classes; g) it is necessary to reform the "Ley de plagas del campo" so as to make hydrocyanic fumigations obligatory in all citrus districts as a remedy for pests which have been proved to be eradicable by this means.

In conclusion, the writer mentions the sum of £6 000 given by the State for the development of the method of controlling *Chrysomphalus*, and gives some special instructions as to the practical application of the treatment described.

